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Involving Local Non-Profit Organizations in the PicturePost Project

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Involving Local Non-Profit Organizations in the PicturePost Project

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ABSTRACT

The Digital Earth Watch program and the Boston Museum of Science have developed an environmental monitoring device called a PicturePost. The PicturePost project had been implemented in an educational setting but faced many obstacles. The project required more participants. The main goal of our project was to involve the Boston area's non-profit organizations. To encourage the organizations' participation we made recommendations to resolve the issues experienced by the educators including the website, uploading process, and the user guides. By solving those problems and gaining more participation, the PicturePost program has a better layout for reaching its educational and scientific potential.

AUTHORSHIP PAGE

Section	Original Author
ABSTRACT ……	Michael Toto
ACKNOWLEDGMENTS ……...	Nelio Franco
EXECUTIVE SUMMARY …….	Tommy Tashjian
CHAPTER 1: INTRODUCTION ……...	Tommy Tashjian
CHAPTER 2: BACKGROUND	
INTRODUCTION ……..	Tommy Tashjian
ENVIRONMENTAL DEGRADATION ……...	Nelio Franco
DIGITAL EARTH WATCH AND PICTUREPOSTS ……...	Nelio Franco
GREENSPACE ……...	Nelio Franco
MARKETING PRINCIPLES ……..	Brian Sealund
ADOPTING NEW TECHNOLOGY ……..	Tommy Tashjian
MOTIVATION AND LEISURE INVOLVEMENT ……..	Brian Sealund
INTERFACE DESIGN ……	Tommy Tashjian
CHAPTER 3: METHODOLOGY ……..	All
CHAPTER 4: FINDINGS ……...	Tommy Tashjian
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS ……..	Michael Toto
APPENDIX A: THE BOSTON MUSEUM OF SCIENCE ……	All
APPENDIX B: DIGITAL EARTH WATCH	
INTRODUCTION ……...	Tommy Tashjian
FORREST WATCH: UNIVERSITY OF NEW HAMPSHIRE ……..	Michael Toto
EOS-WEBSTER: UNIVERSITY OF NEW HAMPSHIRE ……...	Michael Toto
THE REMOTE SENSING AND GIS LABORATORY: INDIANA STATE UNIVERSITY ……	Tommy Tashjian
LAWRENCE HALL OF SCIENCE: UNIVERSITY OF CALIFORNIA, BERKLEY …….	Nelio Franco
RESEARCH AT THE UNIVERSITY OF SOUTHERN MAINE …	Nelio Franco
BLUE HILL OBSERVATORY AND SCIENCE CENTER ……..	Brian Sealund
CONCLUSION ……	Brian Sealund
APPENDIX C: PICTUREPOST INSTALLATION ……...	Michael Toto
APPENDIX D: LIST OF NON-PROFIT ORGANIZATIONS ……..	All
APPENDIX E: EXAMPLE OF NON-PROFIT LETTER ……..	All
APPENDIX F: PICTUREPOST PAMPHLET ……...	Nelio Franco
APPENDIX G: PICTUREPOST USER'S GUIDE……	Tommy Tashjian
APPENDIX H: DIGITAL EARTH WATCH PROTOTYPE WEBSITE…...	Brian Sealund
APPENDIX I: PICTUREPOST PHOTOGRAPHS ……	Nelio Franco

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EXECUTIVE SUMMARY

The Museum of Science has been working with an organization called Digital Earth Watch on a project designed to monitor environmental health. Digital Earth Watch's main goal is to measure changes in vegetation health in order to draw conclusions about the health of the environment. DEW refers to plants as nature's "green canaries." Much like the canaries of the first coal mines, the declination of plant health in an area is a warning sign that the health of other organisms in the area will suffer. By monitoring the health of plants we can form conclusions about the health of the surrounding environment.

The tool with which Digital Earth Watch uses to measure vegetation health is called a PicturePost. A PicturePost is comparable to a permanent tripod on which a digital camera can be placed. Photographers take pictures of the area surrounding the PicturePost in a 360 degree series. Photographs are taken repeatedly over time and uploaded to an online photograph database where they can be used to monitor changes in the health of vegetation in the area.

The goal of our project was to increase participation in the PicturePost project by involving non-profit organizations from the Boston/Cambridge area. We also assessed the current limitations of the PicturePost project by participating ourselves and by interviewing other PicturePost users and investigated possible solutions to those limitations.

During our time in Boston we managed to recruit two non-profit organizations to the PicturePost project. Those two organizations are the Minuteman Counsel of the Boy Scouts of America and the Brookline Conservation Commission. We also made contact with other organizations that expressed interest in the PicturePost project. We recommend that the Museum of Science keep in contact with these groups in order to establish a stronger presence of

PicturePosts in the Cambridge/Boston area. The organizations are listed in chapter five of this document.

From our experiences in the PicturePost project and from our PicturePost user interviews, we explored the obstacles that PicturePost users face. The most common complaint that we received was about the Digital Earth Watch website. The website is out-dated and difficult to navigate. The online PicturePost photograph database is hosted at a third party website called SmugMug. *We recommend that Digital Earth Watch develop a new website that is easier to navigate than the current website. We also recommend that the online photograph database be hosted on the new Digital Earth Watch website rather than a third party website.*

In order to assist Digital Earth Watch with the process of developing an updated website, we developed a prototype website for them to consider. Our prototype website has a more user friendly layout than the current website. *We recommend that Digital Earth Watch use our prototype website as a template upon which to build their updated Digital Earth Watch website.*

A discouraging difficulty that we encountered while participating in the PicturePost project was locating the two previously installed PicturePosts at Fresh Pond. These PicturePosts were not marked on the map of Fresh Pond or advertised on the billboards that are posted at its entrance. *We recommend that the Museum of Science encourage non-profit organizations in the area to adopt and maintain currently installed PicturePosts.* We began that process by replacing a wooden PicturePost at Fresh Pond with a plastic PicturePost and requesting that the Friends of Fresh Pond advertise the locations of their two PicturePosts. The Museum of Science must continue what we have started.

We also recommend that the Museum of Science build long-lasting relationships with current PicturePost participants. By remaining in contact with participants of the PicturePost

project, the Museum of Science can assist them with difficulties that they encounter during the project. Many of the past PicturePost users whom we interviewed encountered difficulties in the logistics of the PicturePost project and had no one to turn to for instructions. These difficulties included installing a PicturePost, designing a lesson plan around the PicturePosts, and uploading photographs to the website database. If the Museum of Science develops a strong relationship and consistently communicates with PicturePost project participants, then participants will be able to get the information and instruction necessary to keep them involved in the PicturePost project.

*Our next recommendation to the Museum of Science is to **slowly** expand the PicturePost project.* If the Museum of Science attempts to expand the PicturePost project to a national scale at this point in time, it is almost certain to fail. The PicturePost project should be more firmly established within Massachusetts before it can be expanded nationally and internationally. By expanding slowly, the Museum of Science can create the close relationship with participants which is described above.

*We also recommend that the Museum of Science **strategically** expand the PicturePost project.* By choosing PicturePost locations carefully, the Museum of Science can ensure that the data collected in the PicturePost photograph database is scientifically useful. We recommend that the Museum of Science target areas that are suspected of being in environmental crisis or are being threatened by urban expansion. By targeting these areas, it will become more likely that the PicturePost data will be used after it has been collected.

Another way to strategically expand the PicturePost project is to target participants with a strong interest in the PicturePost project. A simple method to do that would be to encourage the member institutions of Digital Earth Watch to install a PicturePost. These institutions would be

ideal participants because they already have a strong relationship and communication with the Museum of Science. They will be more likely to make a long-term commitment to the PicturePost project.

In order to ensure that the PicturePost project continues after our time in Boston is over, we developed a list of potential grant funders for the PicturePost project. *We recommend that the Museum of Science apply for a research grant with a non-profit organization in the Boston/Cambridge area.* The non-profit organization and Digital Earth Watch will develop a research question and investigate it using PicturePosts.

The investigation of a research question opens the door to a whole new category of grant funding. For example, the Division of Environmental Biology of the National Science Foundation funds projects that investigate the interaction of species within an ecosystem. Digital Earth Watch could aid in the investigation of a research question like: "Does the invading plant *Purple Loosestrife* affect the health of other plants in an area?"

We also recommend that the Museum of Science investigate environmental grants with broad project requirements. For example, The Boston Foundation distributes grants from the East Boston / Chelsea Environmental Fund that have very broad project requirements. The grant is open to any project that involves the community in the environment. A grant such as this is very well suited for the PicturePost project. With it the Museum of Science could begin to integrate the PicturePost project into middle and high schools throughout Massachusetts.

CONTENTS

FIGURES

CHAPTER 1: INTRODUCTION

Since the Industrial Revolution the acts of humans have severely altered the environment. The destruction of forests and other habitats as well as burning of fossil fuels have caused profound changes to plant and animal life and to the geography of Earth. The world has reached a point at which the actions of humans are harshly impacting the entire natural world. These impacts include receding glaciers, changing of growing seasons and migration patterns, as well as changes in climate that are leading to droughts and floods (Rosenzweig, 2007)

A method to measure environmental changes is an important tool for society to have and to use. One such method is to observe changes in the inhabitants of the environment. The two groups of organisms that can be easily monitored by visual observations are animals and plants.

Animals have the capacity to relocate. They are potentially affected by the characteristics of more than one geographic area as they change location. The complex set of influences on animal health makes it a difficult and imprecise measure of changes in a single, immediate environment (Measuring Vegetation Health, 2006c).

Plants do not have the ability to relocate. Because plants are immobile, the range of influences on their health is more limited to the immediately surrounding environment than the range of influences on animal health. The health of the local environment has significant bearing on the health of plants. That relationship makes changes in plant health an excellent measure of change in their local environment. According to the Measuring Vegetation Health home page (2006c), plants are nature's "green canaries". When the health of the plant life in an area suffers, the health of other organisms is likely to follow.

Boston's Museum of Science has become actively involved in detecting and analyzing changes in vegetation health. The museum, along with six other institutions, founded an

organization called Measuring Vegetation Health (MVH) in 2004 with the help of a research grant from the National Aeronautics and Space Administration (NASA) (Measuring Vegetation Health, 2006f). Recently, the name Measuring Vegetation Health was changed to Digital Earth Watch (DEW). We will refer to the organization as Digital Earth Watch throughout this document. Because the Digital Earth Watch website was still titled "Measuring Vegetation Health" at the time this document was written, all references to the website will be cited as "Measuring Vegetation Health."

Digital Earth Watch was designed to draw conclusions about changes in environmental conditions from observations in changes of plant health (Measuring Vegetation Health, 2006c). One intention of the project's creators is to have the information on plant health used to observe environmental change to aid in decision making in community planning and to demonstrate the importance of maintaining greenspace (Measuring Vegetation Health, 2006i).

One of the main focuses of Digital Earth Watch is the PicturePost project. The PicturePost project was developed as a method of data collection to measure changes in the environment. A PicturePost is a device used to monitor the environment using repeat photography. This is done by taking photographs of an area in a 360° series over time. Users can post their photographs on the PicturePost website, which is hosted by a company called SmugMug, to be shared with other interested viewers. The photographs can be used to track the plant growth in an area or to verify satellite images (Measuring Vegetation Health, 2006i).

Although the PicturePost project has the potential to be extraordinarily useful to many educators and organizations, the Museum of Science has recently had difficulty involving and retaining PicturePost participants. In 2007 a team of WPI students aided the museum in involving educators in the PicturePost project. The team of students expanded the resources

available to teachers and developed lesson plans to encourage participation in the classroom (Kernan, 2007). Although the team of students actively involved classes from nine local schools in the PicturePost project last year, the activity of the PicturePost photograph database has not increased.

One problem with involving local schools in the project is that middle or high school courses last only a term or semester. After that time passes, the same students are no longer involved in the project. The most important part of the PicturePost project is witnessing changes in environment over time. The high school and middle school student participants do not see the change within the time-frame of their science class, and they are not motivated to continue the project on their own.

Because the WPI project performed in 2007 on utilizing PicturePosts in an educational setting has not increased the use of the PicturePost photograph database one year later, we will explore a new avenue. The limitations of a school environment can be overcome by marketing the project toward new groups. Environmentally conscience non-profit organizations have the resources to be more regularly active in the PicturePost project than educators have been. They can add a consistency to the photograph database. The Museum of Science would like to involve the many environmentally driven non-profit organizations in the Cambridge/Boston area in the PicturePost project.

The Digital Earth Watch website serves as another cause of discouragement of participation in the PicturePost project. At the time this document was written the website had not been updated since 2005, and is still titled Measuring Vegetation Health. The website serves as a useful source of information about the project, but it is very difficult to navigate. The site is complex, and the link for PicturePost information is not readily accessible to interested parties.

An evaluation of the website will be discussed further in later parts of this document. Because the gateway to the PicturePost project seems to be the Digital Earth Watch website, this site must be changed to facilitate new participants, and to retain current participants.

The goal of our project was to encourage the use of PicturePosts by involving non-profit organizations in the Cambridge/Boston area that would be interested in investing time and money into monitoring the local environment. We accomplished this by identifying limitations of the current PicturePost project. We also determined how the PicturePost project could benefit a non-profit organization, and identified the type of non-profit organizations that could gain from it. We explored the utility of the PicturePost project for these organizations, as well as the marketing strategies that were necessary to seize their attention. After gathering sufficient information about each organization, we gained contact with each of them to explain the details of the PicturePost project and its benefits to the organization. Involving non-profit organizations in the PicturePost project will expand the collection of data available to the public via SmugMug, which is the website that hosts the PicturePost photograph database. It will also lead to the integration of PicturePost monitoring of more habitats throughout the Boston/Cambridge area. Involving those agencies will ultimately support the main goal of the PicturePost project, which is to provide a database of photographs that can be used to observe changes to the environment by interpreting changes in vegetation health (Measuring Vegetation Health, 2006c).

CHAPTER 2: BACKGROUND

In order to complete the goals of this project, it was necessary to first explore related background topics. First, we investigated the Digital Earth Watch project to better understand the program for which we are recruiting. This was necessary to make an assessment of changes that need to be made in order to involve more participants. Because the purpose of PicturePosts is to monitor greenspaces, we also investigated the importance of maintaining and monitoring greenspaces. In order for the project to be fully understood, basic marketing principles had to be applied to a non-profit audience as well as techniques in launching new technologies to potential interested parties. This was necessary to identify the type of non-profit organization to involve, and to develop a strategy for presenting the project to them as a potential venture. Exploration into characteristics of adoptable products and of organizations that are willing to adopt new technology gave insight to the kind of non-profit groups we were looking for. The final portion of our project was to improve the usability of the Digital Earth Watch website for the PicturePost participants. Techniques in effective interface design were studied to accomplish this goal.

ENVIRONMENTAL DEGRADATION

The International Fund for Agricultural Development (2007) and the World Commission on Environment and Development warn that unless society makes changes of our lifestyle, the world will face irreversible levels of environmental damage and human suffering.

The degree to which the inhabitants of many parts of the world contribute to the crisis of environmental degradation depends on the level of their economic development and their consumption patterns. The United States' soaring consumption rates make this country a leading contributor to the environmental crisis.

There are measures that can be taken in order to prevent further environmental degradation. This project will focus on gathering data about the changing environment and making the data available to the public. Drawing the public's attention to changes in the environment will ultimately lead to the necessary lifestyle changes suggested by the International Fund for Agricultural Development (2007) and the World Commission on Environment and Development.

DIGITAL EARTH WATCH AND PICTUREPOSTS

There are many ways of gathering environmental data. Digital Earth Watch has developed an innovative way of obtaining that data through the use of PicturePosts. A PicturePost is comparable to a tripod on which digital photographs can be taken of the environment in a 360° series over time.

Photographs are taken in the eight directions of the compass, and another picture is taken by the user of the sky in order to monitor the sunlight conditions and the canopy coverage. According to the DEW website (2006i), photographs should be taken from each PicturePost once a day at the beginning of spring and autumn. For the remainder of the year, pictures should be taken once a week.

PicturePosts are built identically to provide constant data. That makes comparison between images at the same site and between images from different PicturePost sites possible. The main purposes of the PicturePosts are to take several pictures throughout a period of time, to observe how the environment changes, and to analyze peculiarities that occur in an area.

PicturePosts are meant to be used by the public, not merely scientists and researchers. The public is also encouraged to purchase or build and install a PicturePost wherever they choose. Pictures can be taken by anyone and can be posted on the DEW *SmugMug* website.

There, the information can be viewed, downloaded, and analyzed (Measuring Vegetation Health, 2006d). Digital Earth Watch developed the database for PicturePost images in order to begin to collect information about the changing environment. The expansion of this information will provide interested researchers with a larger data set to analyze.

Although anyone can purchase and install a PicturePost, DEW has developed a set of guidelines for finding a PicturePost site. The guidelines help to strategically place the PicturePost in order to acquire the best environmental images possible (Measuring Vegetation Health, 2006d). These guidelines are explained in further detail in Appendix C. According to the SmugMug website (2007), PicturePosts have been installed in North Carolina, Rhode Island, and Massachusetts. Massachusetts sites include Menotomy Rocks Park in Arlington, Fresh Pond in Cambridge, and near the National Guard Armory in West Newbury (SmugMug, 2007). Since 2005 there have been 6164 pictures uploaded from Massachusetts, 276 pictures from North Carolina, and 4 from Rhode Island (SmugMug, 2007).

PicturePosts can be beneficial in many ways. A group WPI students in 2007 investigated how the PicturePosts could be used by educational facilities. They worked with nine school representatives to assess how the PicturePosts could be used in the curriculum and how the images could create a learning experience for the students. The PicturePost is ideal for the monitoring of growth patterns and plant life cycles and can be used to provide data on land cover change (Measuring Vegetation Health, 2006i). The PicturePost project would be useful in an ecology unit in a middle or high school biology course.

GREENSPACE

According to Greenspace Scotland (2006a), greenspace is any vegetated land or water within or adjoining an urban area. Greenspace also includes derelict, vacant and contaminated land which has the potential to be transformed. Natural greenspaces, green corridors, amenity grassland, parks, and gardens also fall into the category.

Figure 1: Map of Fresh Pond

The figure above is a map of Fresh Pond, which is located in Cambridge, MA. The green areas bordering the pond are excellent examples of greenspace. They include a park, field, and recreation area that contain vegetation and border an urban area.

Importance of Greenspace

As society evolves technology becomes more advanced, and more land is needed in order to accommodate society's growth. It is important to keep in mind that greenspace must be incorporated in our future as well. In order to understand how important greenspace is, we must first explore how it has helped communities. Greenspaces help to make neighborhoods attractive places for people to live and work (Greenspace Scotland, 2006a). Greenspaces also give a community a common place for meeting and recreation. The people interacting in these

communities benefit through an increased quality of everyday living. (Greenspace Scotland, 2006b).

Greenspace Scotland (2006b) states that other than being a great visual commodity, the presence of greenspace raises effectiveness at work. Greenspace has a great ability to reduce stress and create a pleasant image for the community. Greenspace Scotland (2006b) states that the overall health of the community increases when greenspaces become available. This could be a result of the fact that the citizens of the community now have a soothing place to take walks or ride bicycles.

Greenspaces are also beneficial to the natural environment. Greenspace help regulate air quality and climate, reduce energy consumption by countering the warming effects of paved surfaces, recharge groundwater supplies, and protect lakes and streams from polluted runoff (EcoPlanIT Madison, 1999).

Greenspace and PicturePost

The PicturePost project is directly reliant on the availability of greenspace. On the one hand, without greenspace to monitor, the PicturePost project would dissolve. On the other hand, PicturePosts have the potential to help maintain areas of greenspace. With PicturePosts monitoring cities' greenspaces, information on environmental problems occurring can be discovered before the situation becomes irreversible.

A PicturePost may also draw positive attention to these areas. Placing one on a bike path or park could increase the public use of the area. The project will ultimately encourage city planners to incorporate more greenspaces into cities.

MARKETING PRINCIPLES

Marketing, in general, involves two different products: a good and a service. The PicturePost project is marketing both a service and a good towards a target community of nonprofit organizations. Our goal is to have non-profit organizations continuously involve themselves in the PicturePost project. Currently, there are two key methods of marketing a product: the classic marketing mix and relationship marketing. We will explore these methods and assess which is best suited to the PicturePost project.

The classic marketing mix involves the product itself, its distribution, promotional methods, and the price (Danneels, 2007; Borden, 1964; Kotler, 2006). The marketing mix approach was developed by Neil Borden in the 1950s. According to Grönroos (1997) the marketing mix method was very successful at that time. The market at the time of its creation was saturated with physical products. Grönroos (1997) states that because of that, the approach has been criticized for not considering the marketing of the services that began to flood the market in the 1970s. The marketing mix strategy has been also criticized for not taking the long term relationships, which are required in the sale of most services, into account. The strategy is mainly concerned with making the sale, even if lies have to be fabricated to do so (Grönroos, 1994).

According to Grönroos, recently marketers have challenged the forty year old marketing mix with a new model called relationship marketing. This model fills some of the gaps left by the marketing mix formula. The sale of a service often requires a long-term relationship, and this is considered in the relationship marketing model. According to Grönroos (1997) the relationship marketing strategy weighs the need for good customer service more heavily than the classic marketing mix model. Considering and tailoring to the needs of customers is more

important to the sale of services than goods, because the sale of services often involves repeat customers.

Since our goal is to have nonprofit organizations continue to be involved in the PicturePost system, relationship marketing will be a more useful strategy than the marketing mix. It requires us to begin a long-lasting relationship with the non-profit groups that we target as participants of the project. If the marketing mix were used, the organizations may initially be involved in the project while their interest would eventually wither away over time.

ADOPTING NEW TECHNOLOGY

In order to better understand how to market the new technology of PicturePosts to non-profit organizations, the concepts behind marketing a new technology must be explored. We discuss the characteristics of successfully adopted innovations and explore the characteristics of organizations that adopt new technologies.

Characteristics of an Adoptable Innovation

According to Rogers (1983) in order for a new product to be worth investing in, it must be better than those products that it is intended to replace. This means that it must be more effective, efficient, and easier to use than its predecessor. Rogers (1983) termed this quality "relative advantage."

Meyer, Johnson, and Ethington (1997) studied the role of relative advantage in adoption, when they proposed three innovative techniques of distributing information about cancer to the public. Before implementing the techniques, each was rated by eighty-nine organizations based on six factors of easily adopted innovations. Those factors included relative advantage, compatibility, complexity, trialability, observability, and adaptability. The factors were described by Rogers (1983) as the six important characteristics of easily adopted innovations.

According to Meyer, Johnson and Ethington (1997) the most influential factor on the organizations' decision to adopt was relative advantage.

Aubert and Hamel (2001) came to the same conclusion while studying the adoption of smart cards in the Canadian sector. The relative advantage of smart cards was reported to be the most significant factor in the adopters' decisions. The cards allowed for more efficient communication within the adopting organizations than previous methods. This illustrates the importance of an innovation's relative advantage to its adoption.

An easily adoptable product is also compatible with the needs and values of the potential adopters (Roger, 1983). According to Ram and Sheth (1989) integrating a new technology into the daily business of an organization is one of the biggest challenges faced by developers of new technology. If a company cannot easily envision how a new product can fit into their day-to-day workings, it is far less likely to be adopted.

Aubert and Hamel (2001) reported that while presenting smart cards to various organizations, several commented that one of their best qualities was that they fit easily into the work habits and environments currently existing in the organizations.

Foy et al. (2002) presented innovative clinical practice recommendations to sixteen Scottish hospitals. The researchers performed an audit of the participants of the study, and the attributes of the recommendations that aided or hindered adoption were discussed with the doctors. The recommendations that complied with the current views and values of the doctors were the adopted most often. The recommendations that would create the biggest changes in routine were the adopted least often.

According to Rogers (1983) another important trait in an adoptable product is "trialability". Trialability is the ability of the organization to test the product before fully implementing it.

Grilli and Lomas (1994) investigated twenty-three cases in which medical and surgical procedures guidelines were recommended to hospitals. The researchers surveyed the subjects of cases, and uncovered what characteristics made each innovative idea adoptable or unadoptable. They found that the more easily tested recommendations were adopted the most often. Those recommendations that required more commitment to test were adopted less often. This supports Rogers' statement that trialability is critical to an adoptable product.

According to Rogers (1983) another critical characteristic of an easily adoptable innovation is low complexity. A new product that is simple to understand and to begin using is more readily adopted than a more complex product.

During their earlier described research, Grilli and Lomas (1994) discovered that the least complex medical and surgical procedures, such as obstetric and preventative procedures, were adopted at higher rates than the more complex recommendations, such as cardio and oncological procedures.

Meyer, Johnson, and Ethington (1997) came to similar conclusions in their research involving plans to reach the public with information about cancer. They found that the less complex the method, the more the method was implemented.

Characteristics of PicturePosts

The above described characteristics of an easily adoptable innovation are important to an organization that is marketing a new technology such as PicturePosts. PicturePosts are innovative tools for monitoring environmental health, and they possess many of the characteristics of an easily adoptable product.

The PicturePosts have a high relative advantage, due to the lack of competition in the field of environmental monitoring tools. They also have high trialability, because currently installed PicturePosts are located around the Boston area and can be used before installing a new PicturePost. The PicturePost project also has low complexity, because the equipment required is easy to use.

The compatibility of PicturePosts is more difficult to measure. Their compatibility directly depends on the organizations that are targeted while choosing participants. The leaders of the PicturePost project should consider this variable when selecting organizations to involve.

Types of Adopters

According to Rogers (1983) there are five categories of innovation adopters. Those categories are determined by the values and characteristics of the organizations in relation to their adoption of new technologies. The categories are innovators, early adopters, early majority, late majority, and "laggards".

Rogers (1983) claims that innovators are the gateway through which new innovations reach the world. Innovators are willing to take risks associated with adopting extremely new technology. They also have the technological skills and knowledge required to utilize these innovations. These individuals and organizations strive to find and adopt the newest innovations first. They can also be the developers of new technology. Because innovators are so ahead of

the norm when it comes to innovation adoption, they are somewhat cut off from the rest of the innovation diffusion system. Successful adoption by innovators is not a good indicator of successful adoption by the rest of the public.

According to Rogers (1983) the next two categories of adopters are the most useful to the developers of an innovation. The first of these is the early adopters. Early adopters are less venturesome than innovators. They are more selective when choosing an innovation to adopt; however, other innovation adopters highly respect the decisions of early adopters. In order for an innovation to diffuse throughout a local business structure, it must be approved by early adopters.

Miles et al. (1975) refers to this group of adopters as the prospectors. Their business success depends on their utilization of new products and product markets. Ko, Kincade, and Brown (2000) concluded that these prospectors are the organizations that the developer of an innovative idea should market toward expansion the use of a product.

The next category of adopters is the early majority (Rogers, 1983). They are willing to test new products, and are as selective as the early adopters. The key difference between early majority and early adopters is influence. The early majority members do not have as much influence over the decision of other organizations as early adopters.

Miles et al. (1975) refers to this group of adopters as the analysts, because they require a longer innovation decision process than the early adopters or prospectors. They are willing to take some risks with new ideas, but require more evidence of success. They are the general public, and so should be a direct focus of innovation developer's marketing.

Rogers (1983) states that the next two adopter categories are far less open to innovation. The late majority is more skeptical than the previously described categories. The decision to

adopt is usually caused by necessity, and takes place after nearly all others in the peer group have adopted. That necessity can be economical or social. The late majority is not open to new ideas, and should not be a target audience of an innovation developer.

Miles et al. (1975) agrees that these are important characteristics, but has termed the group "reactors". This is because they are among the last to adopt an innovation, and often decide to adopt to avoid becoming outdated. Directing marketing of new products to this group is usually fruitless, since other groups must demonstrate success before the late majority or reactors begin implementation.

The final group to adopt a new technology is the laggards (Rogers, 1983). The laggards are very traditional, and are usually isolated within their community. They are opposed to innovation, and will only adopt a new idea after an extraordinary long decision process. They must be absolutely sure that the new product will not fail before implementation can even be considered.

Miles et al. (1975) described this group of adopters as defenders, because of their opposition to change. Their main prerogative is to maintain their current stability. This means that they do not seek new ideas, and even avoid them if possible.

Characteristics of Early Adopters

Because the early adopters of an innovation are so important to the diffusion of new ideas, their characteristics have been studied closely. These organizations share a set of characteristics that make them excellent candidates for implementing new technology. Important factors to consider while seeking early adopters include organization size, specialization, centralization, formality, and interconnectedness.

The effect of the size of an organization on its willingness to adopt new technology is the subject of debate. According to Hastings (1976) large companies tend to have a better use for new technology than a smaller company. Larger companies often have a wider set of goals than smaller businesses. Larger organizations may also have greater resources, like time and money, to invest in new technology. Ettlie, Bridges, and O'Keefe (1984) came to similar conclusions. They suggest that as an organization's size increases, its ability and willingness to adopt new ideas increases.

Conversely, according to Hastings (1976), a larger business may have more requirements for approval of adopting a new technology than a smaller business. If this process is not efficient, it may take significantly longer to implement a new idea in a larger organization than in a smaller institution. A smaller organization may have more flexibility for applying fresh ideas than a larger company. A larger company may not want to bother with a practice that has not been thoroughly tested, while a smaller company may be available to test the method.

An organization's specialization has a significant effect on its willingness to adopt new technologies. An organization that has expertise in the same area as the product will be more likely to adopt the product if they are even slightly familiar with it (Moreau et al., 2001). If the product is too new to the company, or if it has not been tested elsewhere first, the expert organization will be more likely to deny early adoption (Moreau et al., 2001). Kimberly and Evanisko (1981) explain that the greater number of specializations that an organization has, the wider its knowledge base is. This wider base makes it easier for an organization to understand and implement a wider set of new ideas.

According to Rogers (1983) organizations with a low level of centralization tend to be more open to the idea of implementing new technology. In a highly centralized organization,

decision making power is limited to a select group of people. The past experiences and views of these few people determine whether a new product will be adopted. Organizations with less centralization include the opinions of a wider range of people in their decision, making implementation of new ideas more likely. Ettlie, Bridges, and O'Keefe (1984) concluded that as an organization became more centralized, its openness to innovations decreased. They suggested that innovation developers market their new products to more decentralized organizations.

According to Rogers (1983) companies that have a more formal approach to daily routine and decision making are less likely to adopt innovative ideas. When a formal approach of decision making is in place, the exchange of new ideas is more restricted. This makes the breaking in of new technology more difficult. Ettlie, Bridges, and O'Keefe (1984) agree on this subject. They study the effects of the size of an organization on innovation adoption decision process. They conclude that formalized communication that is found in a larger company hinders the implementation of new ideas. When trying to promote new technology, organizations that promote a more free flow of ideas should be sought.

Interconnectedness is another trait of an innovative organization (Rogers, 1983). Companies with extensive ties to the surrounding community and excellent interpersonal communication are more apt to learn of and consider new technology (Rogers, 1983). A more isolated organization may not learn of a new idea, or give it due consideration. Miller and Friesen (1982) agree that the more connections an organization has to its local environment, the more access it has to innovative idea. This promotes innovation adoption.

Because involving early adopters is the gateway to diffusing an innovation to other adopters, they should be the main target for marketing of new technologies. The leaders of the

PicturePost project should seek organizations with the above described characteristics, when seeking new participants.

MOTIVATION & LEISURE INVOLVEMENT

A major issue with the PicturePost project is getting people motivated to take pictures and upload them to the database. The Porter-Lawler model of motivation explains why someone may want to use a PicturePost. Lawler's expectancy model depends on the level people value rewards, and people's belief that they will receive these rewards once effort is applied (ECNext Inc., 2001). That will hopefully be the situation with the PicturePosts. In a leisure activity such as taking photographs the reward someone receives is simply the pictures taken or the fact that they know they are helping to monitor the environment. According to a study done by Kyle et al. (2006), motivation must exist before long-term involvement will occur. Though there is a positive correlation between motivation and enduring involvement, it has a different effect for every person. (Kyle, Absher, Hammit, Cavin, 2006) The average PicturePost user will be someone who already cares for the environment, someone who is willing to take time out of their own schedule to better the world around them.

INTERFACE DESIGN

The user base for the PicturePost website is the general public. It currently includes mostly middle and high school students and their teachers; however, the aim of this project is to include other groups of people as well. This will make for a very broad user base. In order for a website to be utilized to its full potential, it must have a user-friendly interface design. An interface is the way that a user interacts with a website (Hackos et al., 1998). It is the design and layout of the webpage. A lot of thought about the users' needs should go into interface design.

The most important feature of a user interface is that it aids the user in accomplishing his or her business in the most efficient manner possible (Hackos et al., 1998). In order to accomplish this, one must understand one's user group. Because the user group is so large, the website must be capable of meeting the needs of users with varying experience with computing. The difficulty that people currently have in navigating the site will turn them off to working with the project.

Dix et al. (2004) explains that one of the most important features of a user-friendly interface is "learnability". The "learnability" of a website is the ease of which a first-time user can get comfortably acquainted with the site enough to use it successfully (Dix et al., 2004). This means that the site needs to be consistent with the user's previous experience with the internet and consistent within itself (Dix et al., 2004).

The DEW website was last updated in 2006, but its appearance is similar to web pages of the early 1990s. The site is left aligned, rather than centered. The centering method draws the eye to the center of the page. This is easier to read and easier for the page developer to highlight important features on the page (Dix et al., 1998). Changes such as this one can help to make the appearance of the DEW website more familiar to the users. The individual pages of the site should also be consistent. This means that links should be marked in a clear and consistent manner, and the main menu links should be in the same order on every webpage (Lynch, 2002).

The changes will make the user more comfortable in using the website, and will allow them to find the way to where they want to be if they get lost in the site. Another important aspect of "learnability" is predictability. When users are navigating a predictable website, they know what will happen after every action they perform (Dix et al., 2004). The DEW website is not very predictable. Some pictures and diagrams are actually unlabeled links. The users have

no idea where these will take them. They must be clearly labeled and marked as links with a predictable format, such as blue underlined text.

The DEW website also needs to be easier to navigate. This means that users should be able to determine where they are and where they need to go to accomplish their goals without much effort (Dix et al., 2004; Lynch, 2002). One technique to help in this capacity would be to group the menu items in a logical manner (Dix et al., 2004). Important links like the PicturePost link should be emphasized, not hidden in a drop-down menu (Dix et al., 2004).

Websites that are designed for the general public must be based upon a user-friendly interface design. In order to increase the use of the DEW photograph database, the user interface must be improved.

CHAPTER 3: METHODOLOGY

The main goal of this project was to increase the usage of the PicturePost program by involving several non-profit organizations in the Boston/Cambridge area. In order to accomplish this, the project had focused on three objectives. The first objective was to gain insight on the PicturePost project by participating in it directly. We did this by installing and using our own PicturePost. The second objective was to gain understanding of how the PicturePost program could benefit local non-profit organizations and how the project could be adapted in order to more specifically tailor to their needs. Our final objective was to improve the portals through which the participants of the project interact with each other and with the heads of the MVH program. The main portal that fosters this interaction is the Digital Earth Watch website. This chapter gives a detailed description of how we accomplished these objectives.

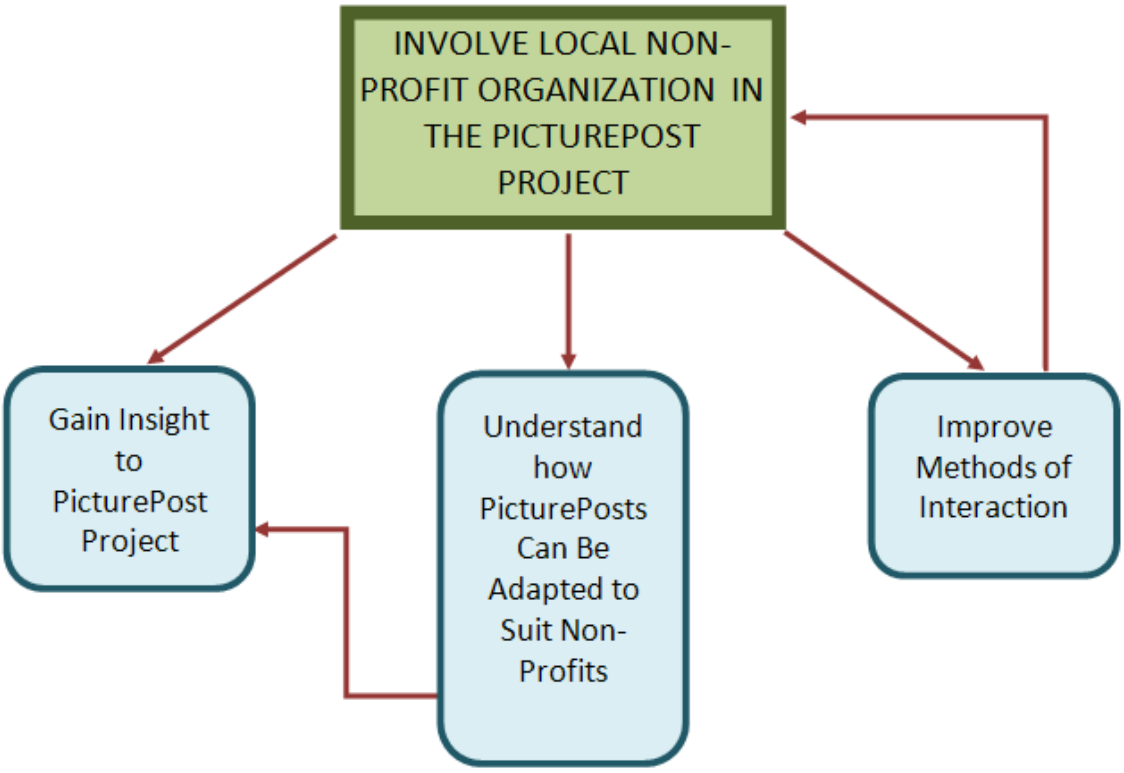


Figure 2: Project Goals

PICTUREPOSTS

As previously stated the purpose of our project was to increase the usage of the PicturePosts. In order to understand the PicturePosts we decided to install one ourselves. By installing one we gained further insight into the complete process through which a participant of the PicturePost project goes. We were able to identify the most complicated pieces of the process and suggest improvements to Digital Earth Watch. The steps that we completed while participating in the PicturePost project are outlined in Figure 3.

First, we chose an environmentally interesting location where a PicturePost would be useful. We decided to replace a previously installed wooden PicturePost at Fresh Pond. The PicturePost was warped and had no attached instructions.

After physically installing the PicturePost, we used it in order to get an idea of what being a participant in the PicturePost project entails. We took the photographs and navigated through the website to upload the images. We took and uploaded pictures once a week for four weeks, while we were in Boston.

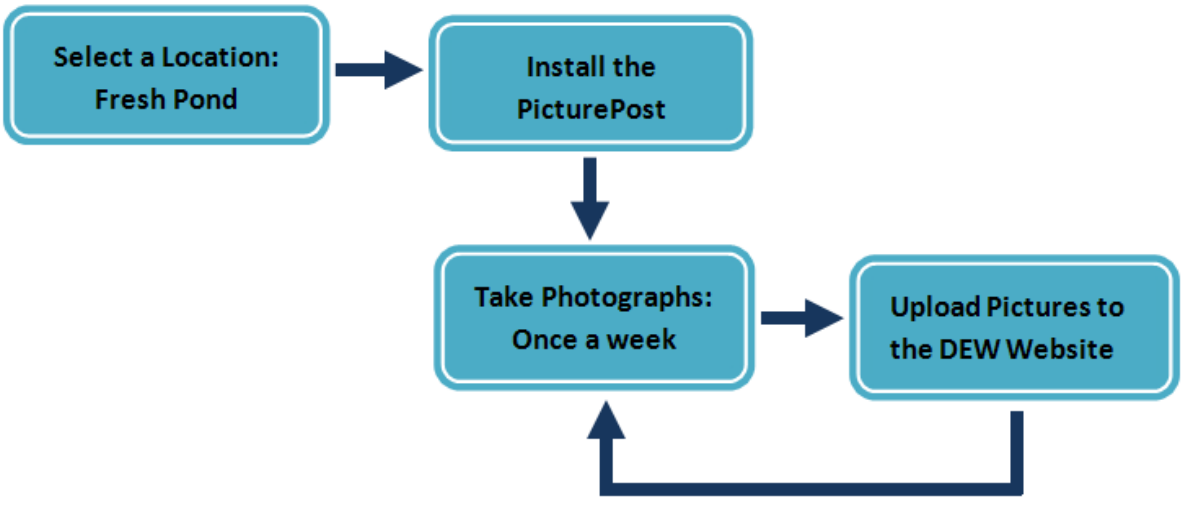


Figure 3: PicturePost Project Step

INVOLVING NON-PROFIT ORGANIZATIONS

The main focus of our project was to involve local non-profit organizations in the PicturePost project. The first step to accomplishing this goal was to understand how the PicturePost project could benefit these organizations**.** To do this, we first assessed the current state of the project by interviewing the nine teachers that were recruited as PicturePost participants by a group of WPI students in 2007. In those interviews we inquired about their current participation, what they liked and disliked about the PicturePost project, and any recommendations they thought would increase participation in the project.

We then presented the PicturePost project to each of non-profit organizations from the Boston/Cambridge area. We assessed the level of interest of the organizations and held a group presentation for the organizations that showed the greatest interest in the PicturePost project.

Interviews with PicturePost Users

In order to gain insight to why past PicturePost users were not continuing their participation, we contacted each of the PicturePost participants that were recruited by the group of WPI students in 2007. Each participant was contacted with an email, telephone, and by a second email.

Four of the participants responded and agreed to grant us an interview. These four were Rebecca Schwer, Tim Herrmann, Lisa Camp, and Christina Connelly. We performed the interview with Christina Connelly at Algonquin Regional High School where she teaches. The other interviews were performed over the telephone.

We asked each of the PicturePost users to explain the positive and negative aspects of the PicturePost project. Their responses are summarized in chapter three of this document. They were used to assess the limitations of the current PicturePost project. Our recommendations to

Digital Earth Watch and the Museum of Science that were based on the PicturePost user interviews are described in chapter four of this document.

Creating a List of Non-profit Organizations

Before we could recruit non-profit organizations to the PicturePost project, we first developed a list of potential non-profit organizations that would be interested in the PicturePost project. We took the names and contact information of the organizations from the telephone directory of the Cambridge area and internet searches. We also used lists of local non-profit organizations from the United Way and the Nonprofit Center of Boston. We used these different sources for our list in order to make sure that no critical non-profit organizations were missed in our searching.

We further researched each organization from that master list using the internet and categorized them to determine if they fulfilled our criteria for targeted organizations. The targeted organizations had to have been environmentally driven. They showed an interest in botany, climate, or wildlife. They were also concerned with the local ecosystems and their changes. We included educational organizations, such as summer camps, and organizations that are involved in community service in our list. Another major set of organizations that was included in our final list were groups controlling bike and hiking trails and groups advocating for the Boston Harbor Islands.

Our goal was to target as many groups as possible but eliminate groups that did not fall under the above described categories. Our final list contained thirty-one non-profit organizations and can be found in Appendix D.

Recruiting Local Non-Profit Organizations to the PicturePost Project

The next step in our project was to recruit each non-profit organization on our list to the PicturePost program. We sent letters to the organizations to briefly present the project to them and to explain how it could benefit their organization. An example of these letters can be found in Appendix E. Next, we made telephone calls to follow up on these letters and request an individual meeting time. We finally visited the organizations that did not respond to our calls to give them a pamphlet explaining PicturePosts. This pamphlet is in Appendix F.

We managed to hold meetings with three of the thirty-one organizations from our original list of non-profit organizations. During those meetings, we informed the non-profit leaders of the purpose of the PicturePost project and described what would be expected of them as participants.

PicturePost User Orientation

At the end of the term, we hosted a PicturePost user orientation at the Museum of Science. We presented the PicturePost program to the most promising organizations from our individual interviews. Those groups were the ones who showed the most interest in the project.

The presentation was created in order to explain the parts of the PicturePost project that were most confusing or difficult to the past PicturePost users. The main focuses were choosing a PicturePost location, installing the PicturePost, and navigating the Digital Earth Watch website. These topics were chosen, because they were areas of difficulty that the PicturePost users we interviewed had encountered.

WEBSITE DESIGN

An important objective of our project was to create a user friendly website that can be accessed by the public. In its current state, the MVH website is confusing to use and the public is not able to upload photos they take at local PicturePost sites. To improve the current website, we completely redesigned the interface with which the user interacts.

We developed a prototype website and shared it with the members of Digital Earth Watch. We reduced the number of links that are visible to the user and organized the information in a more linear form. We also gave the prototype website a cleaner look by changing the color scheme, reducing the number of images, and creating smaller web pages.

To prevent confusion and frustration there is a navigational bar at the top which informs the user exactly where they are in the web site at all times, with each previous page being a click or two away.

GRANT FUNDING

Another important aspect of our project was to research possible grant resources to further fund this program for the future. We began by doing preliminary research on major funding resources such as the National Science Foundation and the Environmental Protection Agency.

Next we met with Ted Russo, the Associate Director of Research Administration at WPI, to help us with funder searching. Mr. Russo suggested a number of grant searching techniques and referred us to his colleague Robert Kruger for further advice. The information received from the interviews of Ted Russo and Robert Kruger is described further in chapter four of this document.

We used Google searches, searches on the website www.grants.gov, and databases available through WPI to find funding opportunities for the PicturePost project. We developed a list of possible funders and their application requirements to present to the members Digital Earth Watch. The results of our searches are described in chapter four of this document.

CHAPTER 4: FINDINGS

The main goal of our project was to involve local non-profit organizations in the PicturePost project. To accomplish this goal, we gained insight on the PicturePost project by directly participating, interviewing past PicturePost users about their experiences with the project, and suggesting improvements for the relationship and communications between PicturePost users and the Digital Earth Watch.

In this chapter we discuss the findings of our investigations into the PicturePost project. First, we discuss the difficulties that we encountered while we participated in the PicturePost project. We also discuss the responses that we received from the PicturePost users about their participation, experiences, and recommendations. Next we discuss the results of the individual recruiting sessions with the non-profit groups of the Boston area and from our group recruiting session with the most promising non-profit groups. At the end of this chapter we discuss the analysis of the problems of the current Digital Earth Watch website.

INSTALLING OUR OWN PICTUREPOST

Instead of installing a PicturePost in a new location we decided to replace a warped PicturePost at Fresh Pond in Cambridge, MA with a long-lasting plastic PicturePost. The first major difficulty in the PicturePost project that we encountered was obtaining permission to install the PicturePost. It took us two weeks to obtain permission. PicturePost participants who install a PicturePost on land that they do not own will encounter this same problem. Any roadblock encountered that early in the PicturePost project will discourage potential participants from continuing the project.

When we went to Fresh Pond to find the site of the wooden PicturePost, we noticed that the PicturePost was not advertised anywhere around the pond and was not marked on the maps

that were posted in the area. Because we had a general idea of where it was located, we were able to find the PicturePost using the map on the Digital Earth Watch website. When we arrived at the site, the PicturePost was not labeled and instructions were not attached. An unlabelled PicturePost that is not advertised in the area or located on a map will not encourage the use of PicturePosts by the general public. Only participants with previous knowledge of the PicturePost project and of the PicturePost's location can utilize that PicturePost.

New PicturePost participants might be able to locate the PicturePost and use it properly, if they obtained directions from the Digital Earth Watch website before exploring the pond. However, any casual observers would have no idea what to do with the PicturePost, if they even stumbled upon it. The unlabeled and unadvertised PicturePost at Fresh Pond is useless to novice users.

The next difficulty that we encountered in the PicturePost project was making the weekly trip to take photographs. The journey from the Museum of Science to Fresh Pond takes about twenty minutes by car, and about forty minutes by subway. The weekly excursion was troublesome and difficult to fit into our busy schedule. Current PicturePost participants have already encountered this same problem. That will be discussed in the next section of this chapter.

The final key barrier that we encountered during our PicturePost experience was uploading the photographs to the Digital Earth Watch database. The instructions from the Digital Earth Watch website were helpful, but the whole process was very time consuming. It takes approximately forty-five minutes to an hour to upload a set of nine photographs. The password that is required to upload photographs was also not posted on the DEW website. The annoyance of having to request the password by email has already discouraged participants from

taking the last and most important step in the project process; that is sharing their data. That topic is discussed more fully in the next section of this chapter.

PICTUREPOST USER INTERVIEWS

We were able to interview four out of the nine PicturePost users from the advisory board of the 2007 WPI project. Those teachers had showed great interest in the PicturePost program and were all given PicturePosts and instructions. They agreed to integrate the PicturePost project into their science classes. We interviewed Rebecca Schwer, Tim Herrmann, Lisa Camp, and Christina Connelly. The other teachers either did not respond to our telephone calls and emails or had moved to different schools.

We first questioned the teachers about their current PicturePost project participation. We learned that only two of the four teachers are currently participating in the project. The decrease in participation of the teachers demonstrates the difficulty that Digital Earth Watch has been having in retaining PicturePost participants.

One of the active participants takes photographs only approximately every other month. Neither of the active participants has uploaded photographs to the online PicturePost database. Of the teachers who were not actively involved in the PicturePost project, one had never even installed her complementary PicturePost. The other inactive PicturePost user was forced to discontinue the PicturePost project in his classroom, because he no longer teaches a course in which it would be appropriate.

Next, we inquired about the PicturePost users' experiences with the project. We especially focused on what they liked and disliked about the PicturePost project. The areas that we focused on were the classroom utility of the PicturePosts, the Digital Earth Watch website, and the general process of using a PicturePost.

The teachers who were still involved in the project liked involving their students in the "bigger picture" of environmental health through the use of the PicturePosts. They reported that their students liked the idea of doing their part to help the environment.

The teachers who were no longer involved in the project said that they had trouble fitting the PicturePost into their curriculum. For example, Tim Herrmann used the PicturePost project in a Natural History course during the 2006-2007 school year but is no longer in charge of the course. The PicturePost project is irrelevant to his current class load.

Another concern of the teachers who are no longer active in the PicturePost project was the time scale of the project. Some of the teachers reported that their students would have been more interested in the project if they could have been involved for a longer period of time. The average high school or middle school course, on average, is completed within a few months. The teachers said that this was not enough time to show the students a drastic enough change for them to become invested in the PicturePost project.

The next topic we asked the teachers about was how they felt about the Digital Earth Watch website. Three out of the four teachers responded that the website was far too confusing for them to navigate easily. The most common complaints were that the website was too difficult to navigate, there were too many links, and the uploading process was too complicated. The challenges of the website discouraged the teachers from sharing the data that they collected in class. Rebecca Schwer suggested that we hold a website training session for the PicturePost participants to overcome this challenge.

When we inquired about the likes and dislikes of the PicturePost project in general, there were two common types of responses. Tim Herrmann and Christina Connelly had difficulty with the actual installation of their PicturePosts. Lisa Camp installed her post in a location that is

about a fifteen minute walk from her classroom. Her biggest challenge is getting to and from her PicturePost during her fifty minutes of class time. We faced similar difficulties when traveling to our PicturePost.

RECRUITING LOCAL NON-PROFIT ORGANIZATIONS TO THE PICTUREPOST PROJECT

The individual recruiting process yielded some solid leads for recruiting new members to the PicturePost project. Of the thirty-one organizations from our list of local non-profits, seven expressed definite interest in the PicturePost project. We sent a pamphlet describing the PicturePost project to those groups. The PicturePost pamphlet is located in Appendix F of this document.

The other non-profit organizations from our list either did not respond to our efforts of communication or told us that they were not interested in the PicturePost project. Every one of these organizations received a letter describing the PicturePost project. An example letter is located in Appendix E of this document. We then followed up with every organization with a telephone call and finally visited each of the nonresponsive organizations to hand deliver a PicturePost pamphlet.

Three of the non-profit organizations from our list agreed to meet with us to discuss the PicturePost project in further detail. These three organizations were the Audubon Society at the Blue Hills Trailside Museum, the Brookline Conservation Commission, and the Boston Minuteman Counsel of the Boy Scouts of America.

We met with representatives of each groups and described the goals of the PicturePost program. We also explained what is expected of PicturePost users. They are expected to choose

a PicturePost location, purchase and install their own PicturePost, as well as take and upload photographs once a week.

The Blue Hills Trailside Museum decided that the PicturePost project did not suit the goals of their organizations. They were more interested in monitoring animal life than plant life. The museum director referred us to a Park Ranger of a local National Park to discuss placing a PicturePost there.

When we explained the program's goals to the Park Ranger, she seemed interested in the PicturePost project, but she had a few concerns. She thought that it would be difficult to get the appropriate permission to place a PicturePost in the National Park. She also told us that the area had a vandalism problem. The PicturePost would be a likely target for that vandalism.

Receiving appropriate permission to install the PicturePost in a National Park would have required more time than we had available during our project, but we decided to start the process. The Park Ranger referred us to the people in charge of issuing the permits that would be required for installing the PicturePost. We sent an email to these people explaining the PicturePost project and received no response. We then followed up with phone calls and received no response. It is possible that a response will be received eventually, but we did not receive one within the time-frame of our project.

We also met with Tom Brady, who is the Conservation Administrator at the Brookline Conservation Commission. He was very excited about the PicturePost project. He requested a pamphlet to present to his commission meeting. When we met with him we explained the purpose of the PicturePost project and what would be expected from his organization as a participant. After telling him the details and our goals he seemed very interested in the project.

We invited Tom Brady and members of his commission to our PicturePost user orientation on April 17, 2008.

We also met with the Boston Minuteman Counsel of the Boy Scouts of America. We gave them an overview of the PicturePost project and our expectations of them as participants. They expressed a strong interest in the PicturePost project as well. They told us that the PicturePost project would be an excellent addition to their Boy Scout camp in Milton. They also thought up the idea of providing inexpensive disposable digital cameras to each group of scouts. This is an excellent idea that will remove some dependencies on the boy scouts themselves to bring cameras. We invited representatives from the counsel to our PicturePost user orientation on April 17, 2008.

PICTUREPOST USER ORIENTATION

We held a PicturePost user orientation for potential participants at the Museum of Science on April 17, 2008. We invited representatives from the Brookline Conservation Commission and the Boston Minuteman Counsel of the Boy Scouts of America. Mr. Brady from the Brookline Conservation Commission also recommended that we invite members of the Brookline Greenspace Alliance, whom were on our original list of local non-profit organizations and were of the seven to express some interest, but were not available for a meeting. We invited the members of Brookline Greenspace Alliance to the orientation by telephone.

Due to Mr. Brady's extremely busy schedule as Conservation Administrator, he had to decline our invitation to the orientation at the last minute. The director of the Brookline Greenspace Alliance declined for the same reasons. However, the Boston Minuteman Counsel sent a representative to learn more about the PicturePost project.

During the orientation we provided the representative from the Boy Scouts with a more detailed explanation of why the PicturePost project was developed and of the purpose of Digital Earth Watch. We also gave her detailed instructions of the steps of the PicturePost process. We gave her copies of our User Guide, which outlines the same steps. This User Guide is located in Appendix G of this document. We ended our presentation with a tour of the Digital Earth Watch website and a demonstration of how to upload photographs to the online database. We concluded the morning by introducing the Boy Scout representative to Brian Rogan, who will serve as her contact to the PicturePost project and Digital Earth Watch after we leave Boston.

WEBSITE DESIGN

Before we could make recommendations for a new Digital Earth Watch website design, we had to assess the problems with the current website. The major problems with the site are the difficult navigation, the overflow of links, and the difficulty of the uploading process.

The first problem that we decided to solve for the new DEW website was the difficult navigation. The biggest problem with the navigation of the website was the navigation bar, which is at the top of every page. The links in the navigation bar changed order from page to page, making it difficult to find specific links when exploring the site. The most important links in the navigation bar, such as the PicturePost links, were hidden in drop down menus.

Another problem with the Digital Earth Watch website was the excess of links on the pages. The links on the website were not clearly labeled, and important links were difficult to find. Links are now clearly labeled with blue underlined text and describe their destination as well.

We have developed a prototype website that solved all of the problems the current DEW website has. There are far fewer links immediately visible on the main page, and back tracking

is easily accomplished through a new additional path viewer. This path shows the user all of the pages they have clicked through in order to get to the site they are currently viewing. Screen shots of our prototype website design and fixes can be viewed in appendix H.

The most severe problem with the Digital Earth Watch website is the uploading process. The instructions on the website are clear and helpful, but the process is very complicated and time consuming. It takes an average of one hour to upload one set of nine photographs. The naming process is the most complicated and time consuming part of the uploading process. It is also important to note that the password that is necessary for uploading photographs is not posted on the DEW website. Unless the participants go out of their way to obtain this password, they cannot post pictures.

In order to solve the problems described above, Digital Earth Watch applied for and received a grant from NASA to create a new Digital Earth Watch website. The University of New Hampshire (UNH) will be in charge of creating and maintaining that website. To help the university with this endeavor, we developed a prototype Digital Earth Watch website. We incorporated solutions to the previously described limitations of the current Digital Earth Watch website. Screenshots of our prototype website can be viewed in Appendix H of this document.

GRANT FUNDING

One of the most important parts of the PicturePost project is outreach. The future of the PicturePost project depends on the ability of Digital Earth Watch and the Museum of Science to find and retain PicturePost participants. Grant funding is required in order to perform that outreach for the PicturePost project. We have developed a list of possible grant funders for the PicturePost project.

Before we began our funder searching, we contacted and interviewed Ted Russo from WPI's Office of Research Administration. He is an expert in searching and applying for research grants. Mr. Russo told us that we wanted should be searching for program funding grants that would allow Digital Earth Watch and the Museum of Science to continue to develop the PicturePost project. He suggested that we perform Google searches, searches on the website www.grants.gov, and to utilize the online databases that are available through WPI's Office of Research Administration webpage.

Ted Russo also directed us to interview two of his colleagues: Terry Adams from WPI's Office of Corporate and Funding Relations and Rob Kruger from WPI's Interdisciplinary and Global Studies Division. Terry Adams declined our requests for an interview because of her busy schedule. Rob Kruger agreed to meet with us for an interview.

During the interview with Rob Kruger, we described the PicturePost project to him and explained that Digital Earth Watch needed funding for an outreach program. He responded by saying that it is very difficult to find that kind of funding. He suggested that we investigate research funding that the Museum of Science could share with a local non-profit organization to use PicturePosts in a research question. That would encourage participation in the PicturePost project and ensure that the PicturePost data is used for a scientific purpose.

We took the advice that we received from Ted Russo and Rob Kruger into account while performing our searching for grant funders. We began by investigating the National Science Foundation, the Environmental Protection Agency, and the US Department of Agriculture. Neither the Environmental Protection Agency nor the US Department of Agriculture had a grant funding program that suited the PicturePost project or a research project that could be supported by PicturePosts.

We did discover that the Environmental Biology Division of the National Science Foundation does fund research that could be supported by PicturePosts. The Environmental Biology Cluster within this division supports research in developing an understanding of interactions between species within an ecosystem. With a grant such as this, the Museum of Science could collaborate with a local non-profit organization to investigate the interactions of plant species in Massachusetts ecosystems.

The National Science Foundation also funds Informal Science Education grants. These grants can be used for planning of conferences, symposia, and workshops. The Museum of Science could use a grant such as this to coordinate with local teachers or a group of WPI students to develop a plan for integrating PicturePosts into middle and high school curriculum. Another possibility is using a grant like this to hold PicturePost user orientations for Massachusetts' teachers and non-profit leaders.

The downside to the Informal Science Education grants is the high level of competition. Not only would the PicturePost project be competing with other non-profits throughout the country for this grant, but it would be competing with other departments within the Museum of Science.

Another possible grant funder is the Boston Foundation. This funding organization provides Twice-Yearly Grants to non-profit organizations in the Boston area. The Boston Foundation provides very broad project requirements. They fund several types of programs. The funded sectors that the PicturePost project is concerned with are education and urban environment. For an education grant the Museum of Science could work with Massachusetts' schools to integrate PicturePosts into the school systems or an after-school program. For an urban environment grant the Museum of Science could use the PicturePost project to help a local

non-profit organization develop a program to inform the public about environmental issues in urban areas.

The Boston Foundation also provides grants from the East Boston/ Chelsea Environmental Fund. The grants that are distributed from this fund have very broad requirements as well. The fund provides grants for any project that involves environmental activities in the East Boston/ Chelsea area. It particularly favors projects that support environmental education or recreational activities that promote environmental leadership. The PicturePost project definitely fits within those parameters.

Another possible funding organization is the Barr Foundation. The Barr Foundation funds programs that involve educating urban residents about environmental issues. Unfortunately, the Barr Foundation does not accept requests for funding and grants funding on an invitation-only manner.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

Based on the information collected through each portion of our project and through the examination of our findings we were able to draw conclusions about steps that the Museum of Science and Digital Earth Watch should take to improve the PicturePost project. From these conclusions we were able to develop recommendations that we believe will benefit the Digital Earth Watch and PicturePost program.

CONCLUDING REMARKS

By taking part in the PicturePost program and contacting past PicturePost users we gained a deeper understanding of the entire PicturePost project process. The process includes everything from the installation of the PicturePost to the taking and uploading of photos. From our weekly photos and our user interviews we were able to recognize the educational value and many of the problems that participants encounter during the course of the project.

Many of the difficulties that we and the past users faced involved the navigation of the Digital Earth Watch website and the uploading and naming process on the SmugMug website. Those problems are due to the fact that the current Digital Earth Watch website is confusing and outdated. We successfully developed a prototype website that fits into the criteria given to us by the Digital Earth Watch representatives. To make the uploading process easier we recommended that the PicturePost photograph database be hosted on the Digital Earth Watch website and that the naming procedure for the photos be automated. Screenshots from our prototype website can be viewed in Appendix H.

While reading the instructions for PicturePost participants on the Digital Earth Watch website, we noticed that most of the information directed toward schools and other educational organizations. We decided to develop a PicturePost User Guide that s directed toward non-profit

organizations. The User Guide provides a more complete set of instructions than the PicturePost website, and leads the PicturePost participant through the PicturePost process step-by-step. It also includes information explaining the purpose of the PicturePost project and the goals of Digital Earth Watch. The User's Guide can be viewed in Appendix G.

By targeting non-profit organizations instead of educators we were able to help expand the PicturePost program to a new field of participants. Environmentally conscious and educational groups took great interest in the program and we were able to involve the local non-profit groups throughout the Boston/Cambridge area in the PicturePost project. By involving such widely known groups as the Boy Scouts we may be opening the door to expanding the PicturePost project nationally.

Because of the busy schedules of non-profit leaders and the limited time we had in Boston, we had difficulty recruiting PicturePost users. Two of the non-profit organizations that we made contact with expressed the strongest interest in the PicturePost project and agreed to install their own PicturePosts. We received several other expressions of interest from other non-profit organizations, but they were not prepared to make a commitment at the time we were in Boston.

We were told that the funding for the PicturePost project will be coming to an end in March 2009. We have developed a list of possible grant funders that would be interested in the PicturePost project. With more funding for the program, participation and expansion for the PicturePost project will become more feasible.

RECOMMENDATIONS

In the course of completing our project and based on our conclusions we have developed a list of recommendations for the PicturePost program that will further benefit and promote the PicturePost project for the future. Below we have developed two lists of recommendations. Our recommendations are directed toward Digital Earth Watch and the Boston Museum of Science.

Recommendations for Digital Earth Watch

- **Continually improve and update the website -** With a new organized website that is constantly updated and easy to use, the PicturePost program has a much better chance of recruiting new participants and retaining current participants.
- **Develop a PicturePost database on the DEW website -** By replacing the SmugMug photograph database with a database that is hosted on the Digital Earth Watch website, users will be able navigate the website and upload photographs more easily. This will draw more and lasting participation in the PicturePost project.
- **Participate in the project -** We recommend that Digital Earth Watch members participate directly in the PicturePost project. By participating in the project they will gain a better understanding of the entire process of installation, photo taking, and uploading. Because the member organizations of Digital Earth Watch are spread across the country, this is an excellent way to expand the PicturePost project to new territories.

Recommendations for the Boston Museum of Science

- **Collaborate with local non-profit organizations on a research grant from the National Science Foundation's Environmental Biology Division -** Because program funding for a project like PicturePost is difficult to find, the Museum of Science should consider applying for research grants to utilize PicturePosts to answer a research question. For example, *Purple Loosestrife* is a plant that has invaded the ecosystems of the northeastern United States. The Museum of Science could cooperate with a local non-profit organization to determine if the presence *Purple Loosestrife* affects the health of the indigenous plants of the area
- **Apply for environmental grants with broad project requirements –** The Boston Foundation distributes grants like the Twice-Yearly Grant and the East Boston/ Chelsea Environmental Fund which have very broad program requirements. The Museum of Science should apply for grants such as these to begin an outreach program to the schools and non-profit organizations of Massachusetts.
- **Maintain a stronger and lasting relationship with PicturePost participants -** Many of the past PicturePost users whom we interviewed had difficulties with the project and needed further instruction. Because they had no one to whom they could direct their questions and concerns, many PicturePost users became discouraged, and their participation in the project suffered. By maintaining communication with PicturePost users, Digital Earth Watch would be able to respond to those questions and concerns and prevent PicturePost users from becoming discouraged with the project.

  We also recommend that a stronger relationship between the PicturePost participants and the Museum of Science or Digital Earth Watch be established **before** an

outreach program begins. Funding for an outreach program will be easier to obtain if the funding institution can demonstrate that the PicturePost project is strong enough to expand. This means that the presence of the PicturePost project in the Boston/Cambridge area should be firmly established before expanding to other areas.

We have begun this process by recruiting local non-profit organizations to the project. Relationships with these organizations must be created and maintained before the PicturePost project can expand to new territories.

- **Continue working to expand the project to other non-profit organizations and schools –** We recommend continuing the work with non-profit organizations to aid in the expansion and popularity of the project. We learned during out recruiting process that the road to recruiting participants is long and trying, but it is also vital to the expansion of the PicturePost project. Non-profit organizations such as environmentally conscience organizations and friends of parks and trails, as well as educational organizations, such as summer camps and schools, are excellent PicturePost project candidates.

  While we were able to recruit two non-profit organizations to the PicturePost project during our time in Boston, we received expressions of interest from several others. In order to expand the PicturePost project in Boston, the Museum of Science could continue contact with the following interested organizations:

  - The Blue Hills Reservation
  - Bike to the Sea
  - Boston Harbor Association
  - Brookline Greenspace Alliance
  - North East Wilderness Trust

- **Expand the PicturePost project slowly and strategically -** If the Museum of Science attempts to expand the PicturePost project to a national scale at this point in time, it is almost certain to fail. The PicturePost project should be more firmly established within Massachusetts before it can be expanded nationally and internationally. By expanding slowly, the Museum of Science can create the close relationship with participants.

  By choosing PicturePost locations carefully, the Museum of Science can ensure that the data collected in the PicturePost photograph database is scientifically useful. We recommend that the Museum of Science target areas that are suspected of being in environmental crisis or are being threatened by urban expansion. By targeting these areas, it will become more likely that the PicturePost data will be used after it has been collected.

  Another way to strategically expand the PicturePost project is to target participants with a strong interest in the PicturePost project. A simple method to do that would be to encourage the member institutions of Digital Earth Watch to install a PicturePost. These institutions would be ideal participants because they already have a strong relationship and communication with the Museum of Science. They will be more likely to make a long-term commitment to the PicturePost project.

- **Encourage non-profit organizations to adopt and maintain maintenance of the currently installed PicturePosts -** There are currently four PicturePosts located in Menotomy Rocks Park in Arlington, MA and two PicturePosts located on Fresh Pond in Cambridge, MA. Those six PicturePosts are located in public areas that are maintained by the Friends of Menotomy Rocks Park and the Friends of Fresh Pond respectively.

Our final recommendation is for the Museum of Science to approach our recommended non-profit organizations with a plan to adopt and maintain these PicturePosts. The organizations would be responsible for all of the required maintenance. Maintenance should include replacing warped wooden PicturePosts and ensuring that instructions are attached to each post. These organizations could also advertise the presence of PicturePosts in their respective areas. We have begun the process described above by replacing a PicturePost at Fresh Pond and requesting that the PicturePost be advertised on the billboards at Fresh Pond.

The PicturePost is a vital asset to education and environmental monitoring. We have begun the process of involving the Boston/Cambridge area's environmentally conscious non-profit organizations and have been contacting past PicturePost users. The next step that should be taken is to begin marketing this project to the public and promote citizen science. To increase participation in the PicturePost project many of the non-profit organizations, schools, and the public must be reminded constantly about the environmental education and the scientific importance of PicturePosts. With the recommendations above, we believe that the PicturePost program can expand and be widely used across the country and for years to come.

APPENDIX A: THE BOSTON MUSEUM OF SCIENCE

The Boston Museum of Science was started in 1830 by a group of six men interested in pursuing the study of natural history (Museum of Science, 2007d). The museum first opened in 1864 under the name The New England Museum of Natural History and it was not until after World War II that it became known as the Boston Museum of Science. Throughout the decades following World War II the museum greatly expanded by adding three new wings, a traveling planetarium, and the Mugar Omni theatre.

With those additions the museum was able to hold more and more exhibits and become the first science museum to cover all aspects of science under one roof. The Museum had established itself as the cutting edge of science education by developing innovative and interactive programs that both entertain and educate. More details about the museum's history are described further on the Museum of Science website at www.mos.org/visitor_info/about_the_museum/history_of_the_museum (Museum of Science, 2007d).

The mission statement provided by the president of the Boston Museum of Science, Ioannis N. Miaoulis, is "to stimulate interest in and further understanding of science and technology and their importance for individuals and for society" (Museum of Science, 2007a). In order to make this mission as successful as possible, the museum's staff and volunteers are dedicated to attracting a wide variety of participants and getting them involved in educational and fun activities (Museum of Science, 2007a).

The museum's exhibit halls are a place where visitors can gain a substantial amount of knowledge about many science topics. One of the current exhibits in the Museum of Science is the Discovery Center. There visitors can engage in hands-on activities that are designed to

encourage discovery through play (Museum of Science, 2007b). Another current exhibit is the Live Animal Exhibit. The Live Animal Center contains more that fifty animal species (Museum of Science, 2007c).

The Museum of Science offers many other attractions, such as the 3-D digital cinema, the IMAX Theater and the museum's Planetarium. Each of those attractions offers a vast amount of knowledge and entertainment to all of the museum's visitors.

In 2002 Boston's Museum of Science added a new goal to its mission statement. That goal was to involve the people of the local community in engineering and technology ventures (Measuring Vegetation Health, 2006g). Today the museum is famous for having over 400 interactive exhibits per year (Measuring Vegetation Health, 2006g).

In 2004 the museum received a grant from NASA and began to develop the Measuring Vegetation Health (MVH) project with the aid of six other institutions (NASA, **2008).** The name of the project was later changed to Digital Earth Watch (DEW). The other institutions involved are:

- The Lawrence Hall of Science, University of California Berkeley
- Forest Watch, University of New Hampshire
- EOS-Webster, University of New Hampshire
- The Remote Sensing and GIS Laboratory, Indiana State University
- The Blue Hill Observatory, Milton, MA
- And the College of Education and Human Development, University of Southern Maine (Measuring Vegetation Health, 2006f).

The Museum of Science has accommodated several exhibits relating to the DEW project. The Butterfly Garden houses several species of butterflies and plants that are viewed by millions

of people each year (Measuring Vegetation Health, 2006f). The Remote Sensing exhibit involved monitoring changes in the ocean using satellite imaging (Measuring Vegetation Health, 2006f). The Seeing the Unseen exhibit and the Light House exhibit both involved the manipulation and detection of visible and non-visible light (Measuring Vegetation Health, 2006f). All of those exhibits introduced the public to various techniques used in detecting environmental change in the DEW project.

The Museum of Science is an independently owned nonprofit institution that gives back to the community in a number of ways. One of those ways is helping those that are part of a minority culture/ethnicity and those with disabilities. A primary goal of the Museum of Science is to form mutually beneficial partnerships with local nonprofit programs representing minority youth and adult groups (Museum of Science, 2007g). Nonprofit organizations that work with under-represented youths or adults are also allowed free access to the museum exhibits (Museum of Science, 2007f).

With over 1.6 million visitors annually, a large portion of which are visiting schools, the Museum of Science continually strives to be an educational asset to the city of Boston. The Museum of Science has established itself as an integral part of the community by providing ample educational information through unique exhibits, and assisting the undereducated minorities.

APPENDIX B: DIGITAL EARTH WATCH

Digital Earth Watch is an organization designed to detect and analyze changes in plant health in order to draw conclusions about the changes in the environmental. The project is also designed to encourage participation of outsiders, namely middle and high school students (Measuring Vegetation Health, 2006c). The investigations into changes in a habitat and causes of these alterations are based on principles of biological sciences.

As a secondary goal, Digital Earth Watch integrates skills from multiple areas, such as the life and physical sciences, technology, and art (Measuring Vegetation Health, 2006c). The manipulations of light used to view environmental changes are backed by principles of the physical sciences. Technology and art are also explored through photography and photographic editing.

Digital Earth Watch is a collaboration of seven founding institutions. These institutions are the Boston Museum of Science, Forest Watch, EOS-Webster, Indiana State University, the Lawrence Hall of Science, the University of Southern Maine, and the Blue Hills Observatory. The role of Boston's Museum of Science in the program is described in Appendix A. The six other founding institutions are still actively involved in the project. While PicturePosts are Boston Museum of Science's major contribution, the other institutions provide other important aid to the DEW project. The role of each institution is slightly different, but all are important to the goal of the program.

Figure 4: Digital Earth Watch Institutions

FOREST WATCH: UNIVERSITY OF NEW HAMPSHIRE

Forest Watch is a New England-wide environmental education program that is designed to introduce both teachers and students to different data analysis methods for assessing the state-of-health of local forest stands. Forest Watch offers workshops for students of all ages and for teachers as well. These workshops help introduce the students and the teachers to hands-on scientific research through forest stand assessment, assessment of damage symptoms, and image processing which then is used by University of New Hampshire researchers to continue their surveying of the health New England's forest (Measuring Vegetation Health, 2006b).

EOS-WEBSTER: UNIVERSITY OF NEW HAMPSHIRE

EOS-WEBSTER is a digital library of Earth Science data serving the needs of both the Earth System Science community and the general public. The library was developed through a 3.5 million dollar grant from NASA and is now supported by the University of New Hampshire's Institute for the Study of Earth, Oceans and Space. The digital library provides data used by scientists, researchers, and teachers that cover many different categories. Data categories include the topics of agriculture, atmospheric deposition and air quality, climate, forest ecosystem and carbon dynamics, water demand, land use and land cover products, and soils.

The library also includes satellite data products, such as Moderate-Resolution Imaging Spectroradiometer (MODIS), Landsat, IKONOS, and satellite derived indices and biophysical parameters. MODIS is a satellite that was launched by NASA in 1999 and is designed to measure large scale global changes such as changes in cloud cover. Landsat and IKONOS are also satellite programs that measure changes in the earth from space. All of these resources are open to the public and can be accessed at any time (EOS-WEBSTER, 2006).

THE REMOTE SENSING AND GIS LABORATORY: INDIANA STATE UNIVERSITY

Indiana State University contributes to Digital Earth Watch in a different way than the other founding institutions. Unlike other the resources of some of the other institutions, Indiana State University's remote sensing and geographic information system (GIS) laboratory is open only to members of the university's community. This lab contains a wide collection of equipment and data that can be used to monitor the environment. The available equipment includes ARCVIEW software, which is GIS software, and large format plotters (Indiana State University, 2005). Students and faculty also have access to digital remote sensing data, a vast aerial photograph collection, and databases of vegetation and soil coverage (Indiana State

University, 2005). The equipment and data sources can be used to study the light, energy, and vegetation health changes in the area (Indiana State University, 2007). The ISU website also has a page where students can explore Digital Earth Watch through online activities and quizzes. The activities involve investigating environmental changes with light interaction and digital remote sensing technology (Indiana State University, 2007). Unfortunately, the activities can only be accessed by students and faculty of ISU.

LAWRENCE HALL OF SCIENCE: UNIVERSITY OF CALIFORNIA, BERKLEY

The Lawrence Hall of Science is located at the University of California at Berkley and is a singular resource center for preschool through high school science and mathematical education (Lawrence Hall of Science, 2007). This public science center offers hands-on experiences for learners of all ages (Lawrence Hall of Science, 2007).

The Lawrence Hall of Science's Global Systems Science (GSS) project provides materials including books and other types of information for high school students to learn about science in context of today's environmental issues (Measuring Vegetation Health, 2006e). The Lawrence Hall of Science is contributing to Digital Earth Watch by incorporating DEW ideas in the GSS Books (Measuring Vegetation Health, 2006e). The GSS has published a vast amount of books, but the books in which Digital Earth Watch has added input to include: "A New World View," "Ecosystem Change" and "Ozone".

RESEARCH AT THE UNIVERSITY OF SOUTHERN MAINE

The University of Southern Maine has joined with Digital Earth Watch and NASA to increase students' understanding of vegetation, trees and plants, as important indicators of changing environmental conditions (University of Southern Maine, 2006).

This cooperation between the Museum of Science and the University of Southern Maine is needed in order to accomplish the goals of Digital Earth Watch. The university's contribution to Digital Earth Watch is the development of learning activities for students in middle and high school about how plants and trees respond to a variety of environmental factors (University of Southern Maine, 2006). They also endeavor to teach students to understand current methods to monitor the reaction of plants to changes in the environment and how natural and human processes influence these conditions (University of Southern Maine, 2006). The university plans on analyzing surveys conducted, test scores, and case study methods at the end of each year of the program, in order to monitor its progress. Individual interviews and focus groups will be conducted with teachers to determine if changes to lesson plans or additional materials are necessary (University of Southern Maine, 2006).

BLUE HILL OBSERVATORY & SCIENCE CENTER

The Blue Hill Meteorological Observatory has been an important asset to the meteorological community for many years; many revolutionary weather experiments and discoveries have taken place at this site. It has been continuously monitoring the climate and weather in the area since its founding in 1885. Daily observations are posted to the internet, where they can be accessed by the public. The Observatory has recently expanded to educate the public with school programs and locally available publications. The Blue Hill Observatory's goal is to sharpen students' life skills by having them observe, measure, postulate, and explore the observatory's findings (The Blue Hill Observatory, 2002).

APPENDIX C: PICTUREPOST INSTALLATION

There are a few major steps that need to be taken when getting involved in the PicturePost project. The first step is choosing the proper location to get the best use out of a PicturePost. Next correct installation of the PicturePost is needed so that the post will stay firmly implanted into the ground. Finally, properly taking and uploading photos is important because if the pictures are taken wrong or not uploaded correctly onto the website the picture data is useless.

CHOOSING A LOCATION

Choosing the location of the PicturePost is the first, and one of the most important steps in successfully completing the PicturePost project. According to Kernan et al. (2007), there are certain criteria that must be considered when selecting PicturePost locations. First, make sure the vegetation of the selected area is abundant. Also looking for a predominant landmark will aid in observing changes over time. A large tree or plant could be a prime example. The locations should have a view of multiple layers of the ecosystem so that comparison between species is possible. The image directed directly up should provide a clear picture of either the tree canopy or the sky above. Erosion must also be taken into account, as the PicturePost should not be put at a risk of dislodging itself. A small but possible concern is also vandalism of the PicturePost, a location with minimal risk is recommended.

INSTALLING THE PICTUREPOST

Once a location has been chosen and a PicturePost has been ordered and obtained it needs to be installed. The recommended tools for proper installation include a post-hole digger, a shovel, a pickaxe, a tamping rod, a drill, a level, and a compass. To put the post in the ground, a

hole of about three feet deep must be dug to make sure the post will be placed below the area's frost depth. The PicturePost should be placed into the ground with approximately four feet of the post above the ground.

TAKING PHOTOGRAPHS

Note the exact time and date before taking photographs. The camera should initially be placed onto the octagon so that its lens is facing the North. Photographs are to be taken in a clockwise order, for a total of eight photographs. Finally, a photo of the sky, vertically above the installed PicturePost is taken. Photos are to be taken once a week for the entire year, but during the spring and autumn, photos are recommended everyday (Measuring Vegetation Health, 2006i).

UPLOADING PHOTOGRAPHS

First the taken photos need to be renamed to represent the exact place and time they were taken, according to the directions on the MVH website (Measuring Vegetation Health, 2006j). Then the user must login to the SmugMug website with the username: "**picklejohnmr@gmail.com"** and password: "postguest", select the PicturePost location and direction and finally upload the photo.

APPENDIX D: LIST OF NON-PROFIT ORGANIZATIONS

Alternatives for Community & Environment
Appalachian Mountain Club
Arlington Boys and Girls Club
Audubon Society: Blue Hills Trailside Museum
Audubon Society: Boston Nature Center
Bike to the Sea
Boston Children's Museum
Boston Harbor Association
Boston Minuteman Council: Boy Scouts
Boys and Girls Clubs of Boston
Brookline Conservation Commission
Brookline Greenspace Alliance
Cambridge Bicycle Committee
Clean Air Task Force
Colonel Daniel Marr Boys and Girls Club
Danvers Bi-Peds
Department of Conservation and Recreation
East Boston Camps
East Boston Summer Playschool
Forest Hills Educational Trust
Friends of the Public Garden
Girl Scouts of Eastern Mass: Boston Headquarters
Green Corps
Greenpeace
Greentimes
Hale Reservation
Island Alliance
Massachusetts Bicycling Coalition
Nature Conservancy
Northeast Wilderness Trust
Roots and Shoots
Save the Harbor/Save the Bay

APPENDIX E: EXAMPLE OF A LETTER TO NON-PROFITS

Museum of Science
c/o Brian Rogan
Science Park
Boston, MA 02114

March 14, 2008

Penn Loh
Executive Director
Alternatives for Community and Environment
2181 Washington Street
Boston, MA 02119

Dear Penn Loh:

The Museum of Science is currently involved in a program called Digital Earth Watch, whose main goal is to monitor the health of the environment. Digital Earth Watch has developed a tool, called a PicturePost, to aid in this type of observation. We, at the Museum of Science, would like to involve the local environmentally conscience non-profit organizations in this project. We are very interested in involving Alternatives for Community and Environment.

What is a PicturePost? A PicturePost is an environmental monitoring device that uses digital photography over time to measure changes in the environment. A PicturePost is easy to install, and the data from these posts can be shared online with the public. The Museum of Science hopes to have these devices installed in local green areas in order to make the public more aware of the changes in the ecosystems of the Cambridge/Boston area. Information collected by these PicturePosts will draw attention to the importance of green spaces to the health of our environment.
We would like to discuss this great program with you in further detail. We can be reached by email at museumd08@wpi.edu. We can also be reached at the office of Brian Rogan in the Museum of Science by phone at (617) 589-4252 or by fax at (617) 589-4448. We will follow up with a phone call soon. We look forward to speaking with you.

Sincerely,

Museum of Science
Digital Earth Watch Representatives

APPENDIX F: PICTUREPOST PAMPHLET

In a few words

The PicturePost is a very useful device both educationally and environmentally. The device is so easy to work with, just about anyone can use the PicturePost. By simply taking 9 quick photos and uploading them to the database, the preservation of many parks and green spaces can be assured.

PicturePosts and the Environment

Museum of Science

Digital Earth Watch

A picturePost placed in an environmentally advanced region

What is it?

The PicturePost is a device used to monitor the environment using repeat photography. This is done by taking pictures of an area in a 360° series. The device is so simple, anyone of any age is capable of using the PicturePost correctly.

The photos taken with the PicturePosts are then uploaded to a database. These photos are stored there and can be looked at, printed and bought by anyone. This allows everyone to be able to view the pictures and analyze them.

Why is it important?

The photos stored in the database support scientific monitoring of the health of our local environments because they provide valuable data to study the growth patterns and timing of plant life cycles. The information gathered from PicturePosts can be proven useful to the environment.

The analysis done using the PicturePost photos can be used to help monitor green space, which can be defined as the "green lungs" of the towns and cities. Green spaces contribute to improving people's physical and mental health by providing places for informal recreation. Green spaces help regulate air quality and climate, reduce energy consumption by countering the warming effects of paved surfaces, recharge groundwater supplies, and protect lakes and streams form polluted runoff. By doing analysis based on the photos taken, scientists can find out, for example, why plants are dying and why others are thriving. Many more discoveries can be made from the analyses.

PicturePost can also be proven useful to students and campers. Teachers can teach their students about the environment by taking them out to the nearby park and taking a few pictures with their classes. Campers have an advantage since they are usually surrounded by nature.

Who can use it?

The PicturePost is perfect for anyone who loves to walk, hike, bike or just relax outside. The only thing needed is a digital camera, which can be easily carried around. Photographers would also enjoy PicturePost because it allows them to do what they enjoy doing while helping the improve the quality of the environment around them. Each

Each PicturePost has a set of directions that has be laminated and attached to it that explains exactly how to use it. This ensures that there can be no misunderstanding on how to use the PicturePost.

The RAPcap™ is placed on the post and is the main device used to take pictures

Figure 5: PicturePost Informational Pamphlet

APPENDIX G: PICTUREPOST USER'S GUIDE:

Digital Earth Watch and PicturePosts

PicturePost User's Guide

Authors:
Tommy Tashjian
Michael Toto
Nelio Franco
Brian Sealund

Museum of Science Contact:
Brian Rogan
Program Manager
Earth and Space Education
Educator Resource Development
Tel: (617) 589-4252
Email: brogan@mos.org

TABLE OF CONTENTS

WHAT IS DIGITAL EARTH WATCH?

Digital Earth Watch is an organization designed to detect and analyze changes in plant health in order to draw conclusions about the changes in the environment. The project is also designed to encourage participation of outsiders, such as middle and high school students as well as non-profit organizations.

Digital Earth Watch is a collaboration of seven founding institutions. These institutions contribute to Digital Earth Watch in different ways. Boston's Museum of Science has been working with a tool called a PicturePost to monitor environmental changes. The other institutions that are involved in the project are:

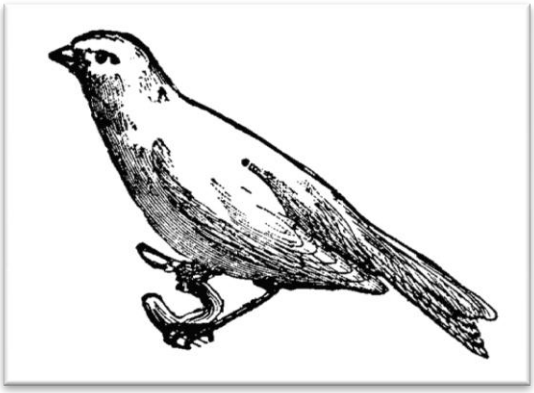
- Forrest Watch: University of New Hampshire
- EOS-Webster: University of New Hampshire
- Remote Sensing and GIS Laboratory: Indiana State University
- Lawrence Hall of Science: University of California, Berkley
- University of Southern Maine
- Blue Hill Observatory and Science Center

The roles of these institutions in Digital Earth Watch are described online at: http://mvh.sr.unh.edu/partners.htm.

QUICK NOTE ABOUT DIGITAL EARTH WATCH

Digital Earth Watch has recently changed its name from "Measuring Vegetation Health." The Digital Earth Watch website is still titled "Measuring Vegetation Health." So, when you hear or read the name Measuring Vegetation Health you can assume that it is the same organization as Digital Earth Watch.

WHY MONITOR PLANT HEALTH?



One of the first warning systems for coal miners utilized canaries to warn miners of the presence of methane gas. A canary was placed in a coal mine. If it died, the miners knew that dangerous methane gas was present. The miners could get out of the mine safely.

Plants are nature's "green canaries." When the health of plant life in an area suffers, the health of other organisms in the area is soon to decline. By measuring the health of plants, we can draw conclusions about environmental conditions that affect all nearby organisms. If we see the plant health of an area is suffering, society can make lifestyle changes to prevent further damage.

WHAT IS A PICTUREPOST?

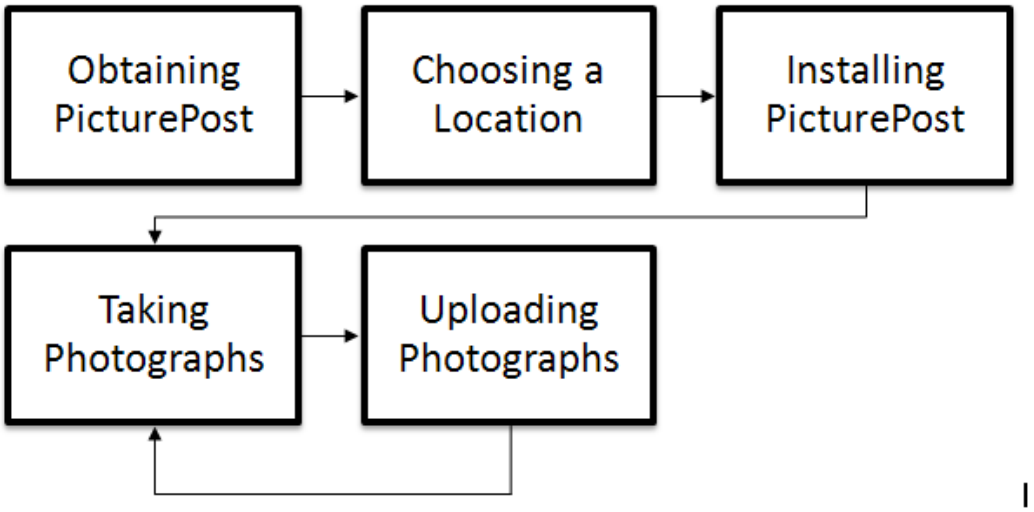
There are many ways of gathering environmental data. Digital Earth Watch has developed an innovative way of obtaining that data through the use of PicturePosts. A PicturePost is a wooden or plastic post used to hold a camera in order to take photographs of an area in a 360° series.

The PicturePost photographs should be taken about once a week, and are used to monitor changes in the environment over time. One can observe changes in plant health over time, as well as view the drastic changes of spring "green-up" and "green-down." One can also observe changes in canopy cover, water levels of ponds and lakes, and air conditions.

Photographs are uploaded onto the PicturePost website, where they are shared with other participants and researchers. The PicturePost photograph database is online at http://picturepost.smugmug.com/.

“THE PICTUREPOST PROCESS”

As a PicturePost participant, you will be responsible for the five steps of the “PicturePost process.” These steps are obtaining the PicturePost, selecting a location, installing the PicturePost, taking photographs, and uploading the photograph to the Digital Earth Watch online database. These steps will be described in detail below.



STEP 1: OBTAINING YOUR PICTUREPOST

There are two ways to obtain a PicturePost. You can build your own or buy one. Building a PicturePost out of wood requires only about $25 of materials. A wooden PicturePost can be placed anywhere, but is susceptible to warping and rotting. Those PicturePosts must be replaced often. The exact replacement time depends on the conditions of the area in which it is placed. Instructions to build a PicturePost will be provided in Appendix A.

Plastic PicturePosts can be purchased for $45 plus shipping costs from EOS Plastic Lumber. They are made of recycled plastic and are guaranteed to last for fifty years. To order online go to: https://omega.mc.net/epsplasticlumber.com/orderform_recap.php.

STEP 2: CHOOSING A LOCATION

Choosing a location for your PicturePost is an important step of the process. The type and quality of data will directly depend on your location choice. Your organization may have a specific goal or site already in mind, but we have provided some general guidelines for choosing a PicturePost location below.

- The PicturePost should be placed in a greenspace. This means that it should be surrounded by vegetation in order to make observation of plant life efficient and the data useful.

- It is beneficial to the PicturePost project to include as many environmental features within view of the PicturePost as possible. These features could be lakes, ponds, hills, rocks, and a variety of vegetation.

- It is a good idea to include at least one "landmark feature" within view of the PicturePost. This feature will serve as a reference point for comparing data from that location.

- Try to choose a location that can capture vegetation in each of the herbaceous (ground-level), shrub (mid-level) and canopy (tree-level) "layers" of the environment. You will be able to compare the different level of impact by environmental influences on these different layers. You will also see the stunning changes of these layers during spring green-up and autumn green-down.

- The PicturePost should also be accessible by the public, but located in area with low risk for vandalism.

STEP 3: INSTALLING YOUR PICTUREPOST

The instructions for installing a PicturePost that are described here refer to the installation of a plastic PicturePost. If you choose to build your own wooden PicturePost, see Appendix A for instructions. All of the instructions can be found online at http://mvh.sr.unh.edu/mvhtools/build_picturepost.htm.

Recommended Equipment:

- PicturePost from EPS Plastic Lumber
- Shovel or Post Digger
- Compass
- Level
- Electric Drill
- 4 Wood Screws (or plastic lumber if available)

Instructions:

1. Dig a hole at least 3 feet deep and wide enough for the 4x4 PicturePost. (The PicturePost must be installed below frost depth. In the Boston area, that is about 3 feet. For the frost depth of your area, consult local builders.)
2. Use a level to keep the post level, while back filling the hole with dirt. Make sure to check the level in all directions and to stamp the dirt until it is firm and the post is stable.
3. Find **true north** for your area online at: http://www.thecompassstore.com/decvar.html. For the Boston area in early 2008, ***magnetic north*** is 15 degrees west of ***true north***. See the picture at the right. Notice that the compass is held so that the white tip of the compass, which points north, points 15 degrees west of north.
4. Align the post cap so that the north directions points to **true north.** Double check alignments and drill four holes through the post head into the post. Secure with the drywall screws.

5. Using permanent marker or paint, label the post head with location information and attach basic instructions.
6. Now, PHOTOGRAPH AWAY!!!

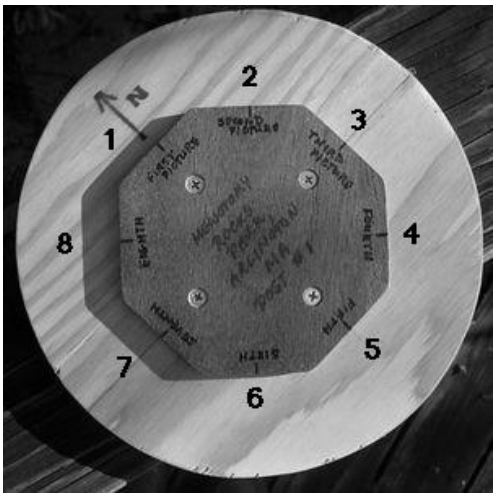
STEP 4: TAKING PICTUREPOST PHOTOGRAPHS

Taking PicturePost photographs is as simple as using a tripod. We suggest using a digital camera, so that pictures can be uploaded to the PicturePost database. In order to simplify the naming process before uploading, you should take your photographs in a specific manner described below. These instructions are also available online at: http://mvh.sr.unh.edu/mvhtools/taking_photos.htm.

Instructions:

1. Record the date, time, and location of your photographs. We suggest taking a photograph of a watch and the PicturePost cap for this purpose. (See picture at the right.)

2. Take 8 photographs of the landscape and 1 of the sky.
    - Make sure that the zoom lens is set to the widest angle.
    - Take the first photograph with the back of the camera against the **north** side of the octagon.
    - Take photographs in a **clockwise** manner (north, northeast, east, southeast, etc.)
    - Take a photograph with the camera on its back and the bottom edge of the camera aligned with the **north** side of the octagon to record sky or canopy conditions.



How often should you take photographs?

- During a most of the year, take photographs once a week.
- To study the seasonal plant cycles, take photographs at least once a day during spring "green up" and during autumn "green down."
- Coordinate with a group of photographers during the busy weeks.

STEP 5: UPLOADING PHOTOGRAPHS

It is very important to upload your PicturePost photographs to the correct folder in the PicturePost database, so that the database has consistent data that will be useful in analysis. The instructions below will help you through the uploading process. These instructions can also be found online at: http://mvh.sr.unh.edu/mvhtools/uploading_photos.htm.

Because the PicturePost website is meant to serve as a database for environmental data, we have guidelines for photographs that are acceptable for the uploading. Please read them in Appendix B.

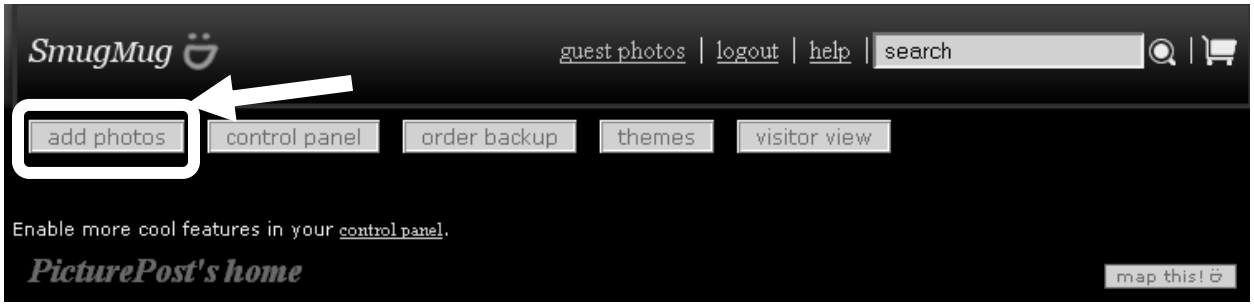
1. Logging In

- Go to http://picturepost.smugmug.com/.
- Click on "login"
- Use email: "picklejohnmr@gmail.com" and password: "postguest"

2. Setting up a folder for your PicturePost

Before you upload any photographs, you will have to create folders in the PicturePost database for you PicturePost. The instructions to do this are explained here:

- At the PicturePost database home page (http://picturepost.smugmug.com/), click "add photos"



- Click on “New Gallery

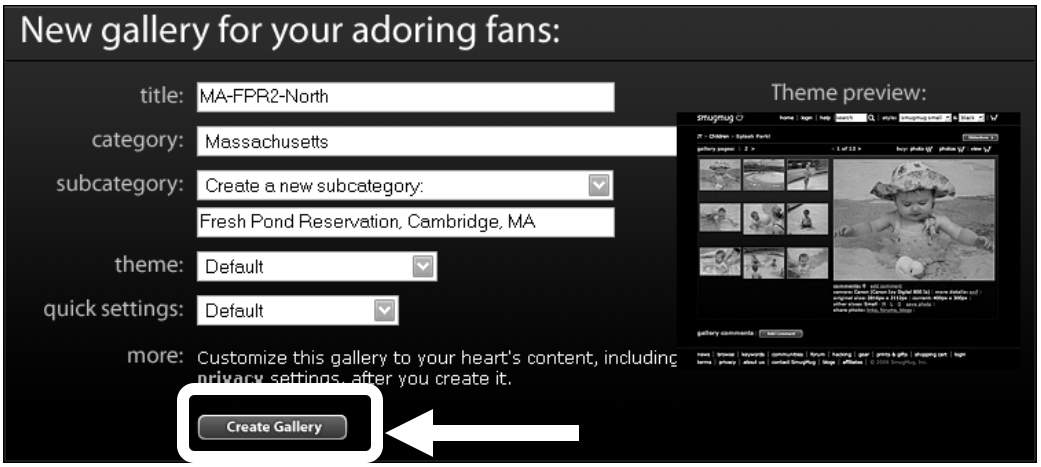
- For “title” type in: “state abbreviation”-“three letter code for PicturePost and post number”-“compass direction”
    - Note: You will have to make up a three letter code for your PicturePost. Like the example, it should reflect the PicturePost’s location.
    - For example see below

- For the “category” choose the state in which your PicturePost is located. If you do not see your state, select “Create a new category” and type in your state.

- For the “subcategory” select “Create a new subcategory” and type in the park or school, city, and state abbreviation of your PicturePost. (In the example below, that is “Fresh Pond Reservation, Cambridge, MA.”)

- Leave the “theme” and “quick settings” as default and click “Create Gallery.”

- Repeat these steps for Northeast, East, Southeast, South, Southwest, West, Northwest, and Sky.



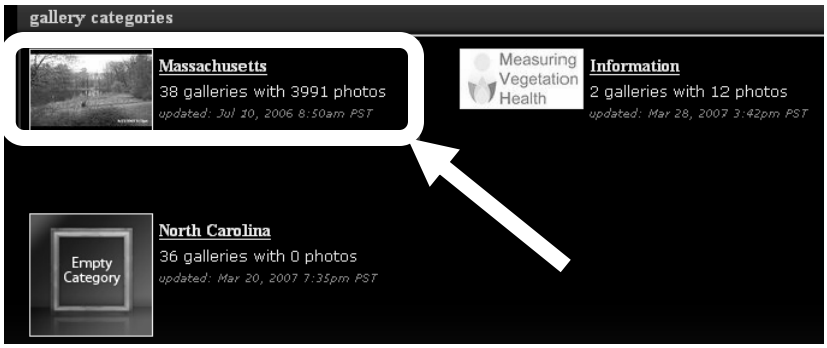
3. Renaming your photographs

A program designed to assist you in renaming your photographs is available online at http://mvh.sr.unh.edu/mvhtools/picturepost_intro.htm. The instructions below can also be used in place of that program. Once the photographs are uploaded to the PicturePost database, they cannot be renamed!!! Please follow these rules.

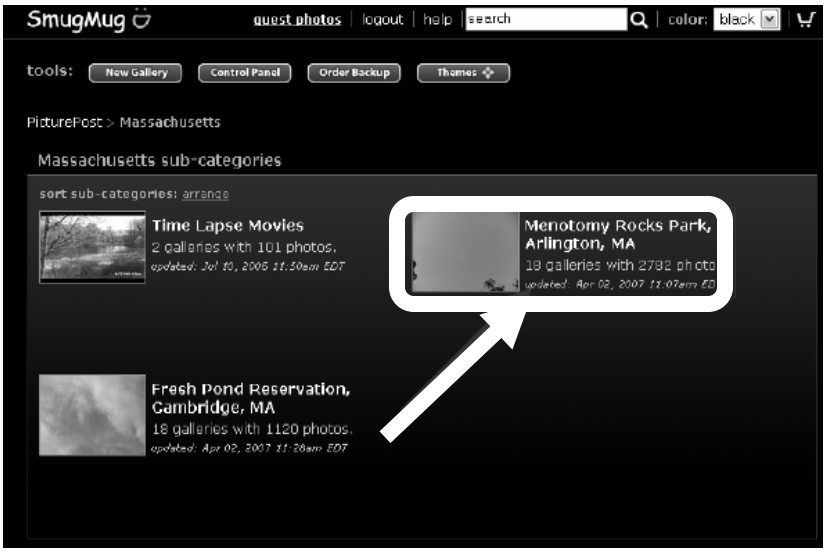
SSPPP#CCYYMMDDHHmmii.jpg

- SS = State Abbreviation
    - (For abbreviations go to: www.ups.com/ncsc/lookups.usps_abbreviations.html.)
- PPP = 3-letter Park location
    - ***MRP*** = Menotomy Rocks Park, Arlington, MA
    - ***FPR*** = Fresh Pond Reservation, Cambridge, MA
    - ***RVC*** = River Valley Charter School, Newburyport, MA
    - ***AHS*** = Andover High School, Andover, MA
    - ***KMS*** = Kennedy Middle School, Natick, MA
    - ***CAC*** = Concord Academy, Concord, MA
    - ***PRP*** = Prairie Ridge, Raleigh, NC
    - ***EEC*** = Audubon Society, RI
    - When you set up the folders for you PicturePost, you created a three-letter code for your PicturePost. Use this code here.
- # = Specific number of the post in the park
- CC – Direction Camera is pointing
    - **NN** = North
    - **NE** = Northeast
    - **EE** = East
    - **SE** = Southeast
    - **SS** = South
    - **SW** = Southwest
    - **WW** = West
    - **NW** = Northwest
    - **SKY** = Camera pointing skyward
- YY = Year
- MM = Month
- DD = Day of month
- HH = Local hour (on the 24 hour clock)
- mm = Minutes
- ii = Additional information (i.e. IR = infrared photograph)

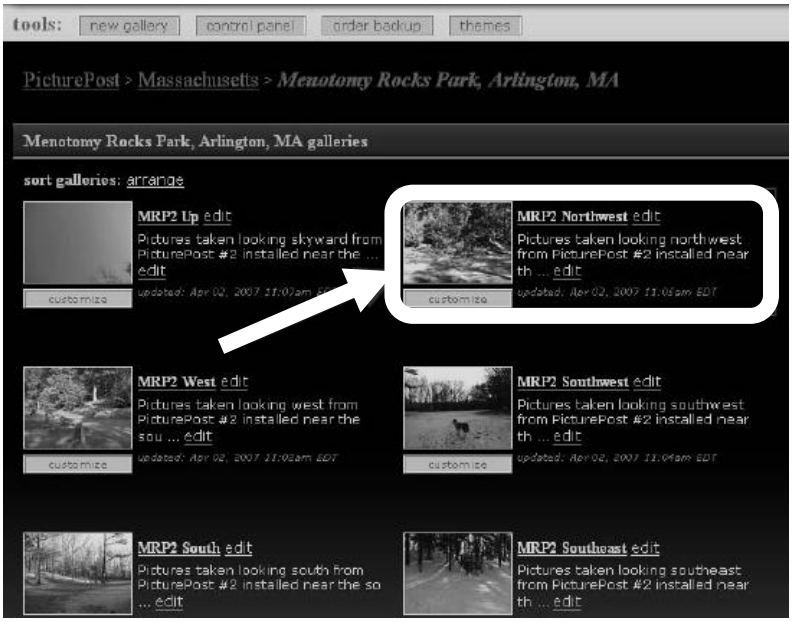
4. **Pick your state**



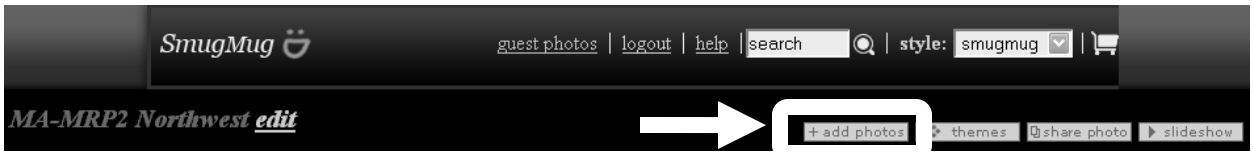
5. **Pick the Park**



6. **Pick the Direction**

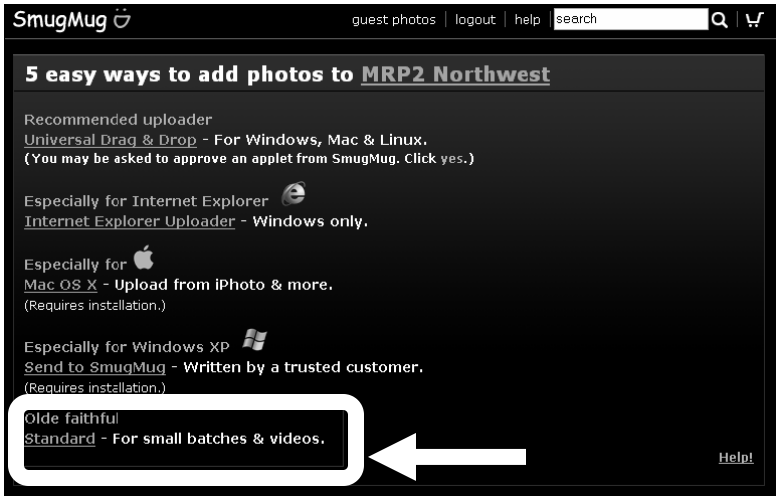


Click "Add Photos"



7. Select an upload process

Standard provides the easiest procedure.



Browse your computer to find your photos

- Double check location, post number, and direction
- Click "Add Photos

8. Repeat steps 6-9 until all directions are added for your post.

YOU ARE FINISHED!!!

QUICK NOTE ABOUT THE PICTUREPOST WEBSITE

At the time this user guide was compiled, Digital Earth Watch was designing a new PicturePost website. All references to online instructions and directions for uploading photographs refer to the website that was in place in April 2008. These links and instructions will change when a new PicturePost website is designed.

WHAT CAN I DO WITH MY PICTURES NOW?

After you upload you PicturePost photographs to the online database, what will you do with them next? In this section, we will give you a few fun suggestions of how you can enjoy your photographs outside of the PicturePost database.

CREATE A PANORAMA!

The 360° series of photographs that you take at a PicturePost can be transformed into one panorama using free software. It will provide you with the entire 360° view from your PicturePost in one photograph. So place your PicturePost in an aesthetically pleasing area so that you can create beautiful panoramas of the area while you help the environment. Here are some websites with software to make panoramas:

1. **The Panorama Factory:** This is free software that stitches together photographs to make panoramas.
    - Go online to download: http://www.foto-freeware.de/panoramafactory.php
    - Make sure that you add the photographs into the program in an order that places the correct photographs beside each other.
2. **Autopano Pro:** This is not a free program. It costs 99 € or about $145 for the complete version. You can manipulate your photographs more with this program. You can download a trial version for free.
    - Go to: http://www.autopano.net/
    - Download the free trial or buy the complete version.

CREATE A TIME LAPSE MOVIE!

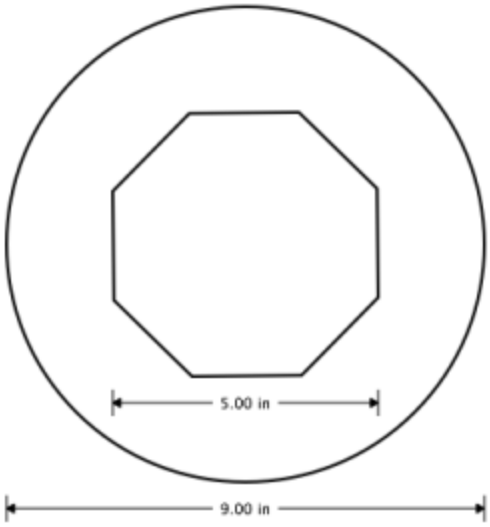
By making a time lapse movie out of your photographs, you can observe changes in plant health and growth. To make a movie, you will need to take several pictures from one view of the PicturePost or download them from the PicturePost database. We suggest using Windows Movie Maker or Apple's QuickTime Pro.

APPENDIX A: BUILDING A WOODEN PICTUREPOST

These directions are from the Digital Earth Watch website and can be viewed online at: http://mvh.sr.unh.edu/mvhtools/build_picturepost.htm.

Materials:

- 7 to 8 foot 4-inch x 4-inch post (consider pressure-treated lumber or plastic composite lumber)
- 9-inch diameter plywood disc, 3/4-inch thick
- 5-inch plywood octagon (with 2-inch sides), 3/8-inch to 1/2-inch thick
- Permanent marker OR paint with fine tipped brush
- Exterior Quality Glue
- Exterior Quality Polyurethane

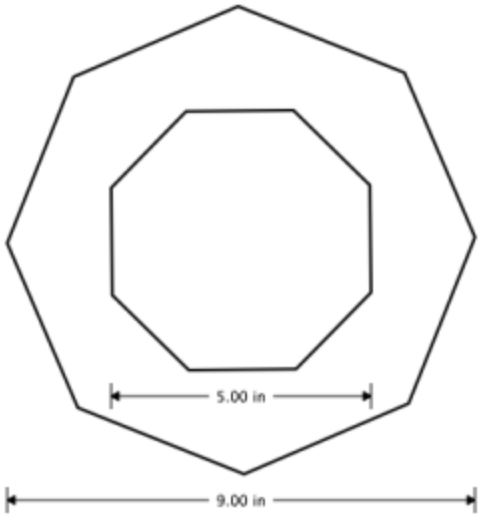


Equipment:

- Saw

Step 1: Building the Post Head

1. Cut 9-inch disc or octagon (See diagrams to the right)
2. Cut 5-inch octagon
3. Center and glue the 5-inch octagon to the 9-inch disk or octagon
4. Add polyurethane with several coats.



Step2: Installing the Post

Now that you have made the post cap, you can use the same instructions for installing a plastic PicturePost to install your home-made PicturePost. See Page 6 of this document.

APPENDIX B: ACCEPTABLE PICTUREPOST PHOTOGRAPHS

Because the PicturePost database is a public website and is meant to serve as a database for environmental data, Digital Earth Watch has rules for uploading photographs. They are described below.

- All photographs that are uploaded to the PicturePost database must have been taken from a PicturePost.
- Photographs that are in a public place can contain people if they are within view of the PicturePost, but it should not be the goal of the photographer to include those people. This means that photographs on the PicturePost website should be taken to include as much environmental data as possible.
- Digital Earth Watch and SmugMug ask you that photographs posted on the site not be of an inappropriate nature. Please do not post images of nudity, drug use, other illegal activities, or anything of that nature.
- We also ask you to not "spam" the PicturePost database with advertisements and announcements.
- It is important that all PicturePost users follow the terms of use set by SmugMug. The terms can be viewed online at: http://www.smugmug.com/aboutus/terms.mg.
- If any PicturePost user violates these rules, the password for website access will be changed. The new password will only be given to a select group of users. If the password for the PicturePost database stops working, please contact John Pickle at picklejohnmr@gmail.com for the new password.
- If you have a question about the rules that are described above, please contact John Pickle at picklejohnmr@gmail.com.

APPENDIX C: CONTACT WITH QUESTIONS

If you have a question about PicturePosts or this user's guide, please contact Brian Rogan at the Museum of Science:

Brian Rogan
Program Manager
Earth and Space Education
Educator Resource Development
Tel: (617) 589-4252
Email: brogan@mos.org

For questions about the PicturePost database on SmugMug, please contact:

John Pickle
picklejohnmr@gmail.com

APPENDIX H: DIGITAL EARTH WATCH PROTOTYPE WEBSITE

This appendix includes screenshots of the prototype Digital Earth Watch website that we developed.

Digital Earth Watch

Partners | Plants & Animals | Remote Sensing | Tools | Light & Color

Home › Tools › PicturePost › Introduction ›

Introduction to PicturePost

Pictures of the same location provide a wealth of information and data to monitor changing environmental conditions. The United States Geological Survey (USGS) has research projects devoted to "repeat photography", such as documenting Mojave Desert Ghost Towns and Mining Sites. Woods Hole Research Center has taken this a step further by accumulating aerial photographs over the same area.

Setting up the camera to take photographs of the same location can be time consuming, and it is not practical to leave the camera in the field, waiting to take the next photograph. Our project team worked with several local park groups in the Boston area to create a stable platform in which people use their digital cameras to take repeat photographs of not just one scene, but the complete 360° landscape in less than a minute. We have also created a free website for people to upload their pictures for others to view. This is our PicturePost system.

If your school, community center, science center, zoo, arboretum, botanical garden is interested in building and installing their own PicturePost (about $20 and an evening of time to build and an hour or two to install), contact us so we may set up a FREE folder for your pictures to be shared with others.

How-To Documents

Build & Install

Taking Photos

Uploading Photos

View existing Photos

Example Movies & Time Series

Figure 6: Introduction to PicturePosts

Digital Earth Watch

Partners | Plants & Animals | Remote Sensing | Tools | Light & Color

Home › Tools › PicturePost › Building a PicturePost ›

Build & Install a PicturePost

Step-by-step instructions of building and installing your own picture post in any location, even in your own backyard!

Materials

(Cost ~ $20-$30)
7 to 8 foot 4″ x 4″ post (consider pressure-treated lumber or plastic composite lumber)
9-inch diameter plywood disc, 3/4″ thick
5-inch plywood octagon (2-inch sides) 3/8″ to 1/2″ thick
Permanent marker or paint with fine tipped brush
Four 3″ to 3.5″ coarse thread exterior drywall screws
Glue (exterior quality)
Polyurethane (exterior quality)

Equipment

Portable drill and 1/8″ drill bit
Saw
Shovel or post-hole digger
Compass
GPS (Global Positioning Satellite device)

Step 1: Build the Post Head

Cut 9-inch disc (If cannot cut a circle, cut a 9-inch octagon–see example on right)
Cut 5-inch octagon
Center and glue 5″ octagon to 9″ disc
Polyurethane with several coats

How-To Documents

Build & Install
Taking Photos
Uploading Photos
View existing Photos
Example Movies & Time Series

(Click images to enlarge)

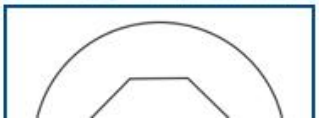


Figure 7: Building a PicturePost

Digital Earth Watch

Partners | Plants & Animals | Remote Sensing | Tools | Light & Color

Home » Tools » PicturePost » Taking Photographs »

Using PicturePosts

Step-by-Step instructions of how to take pictures from the PicturePosts

What is a PicturePost?

A Picture Post is an easy-to-use tool that lets you take digital photographs of the same landscape every time you use the post. By collecting and sharing these images, we may watch and measure the seasonal patterns of nature.

Who may use a PicturePost?

Anyone with a digital camera may take pictures from these posts and share them on our free website.

Why use a PicturePost?

1) These photos support scientific monitoring of the health of our local environments because they provide valuable data to study the growth patterns and timing of plant life cycles.
2) The photos help scientists verify what we are seeing from satellites.
3) The photos support classroom visits to local parks since students may explore how the park changes before and after their visit.
4) Taken over years, these photos support community planning by providing data on land cover change./p>

Recommended Equipment

Any digital camera will do.

How-To Documents

Build & Install

Taking Photos

Uploading Photos

View existing Photos

Example Movies & Time Series

(Click images to enlarge)

Figure 8: Taking Photographs

Figure 9: Uploading Images

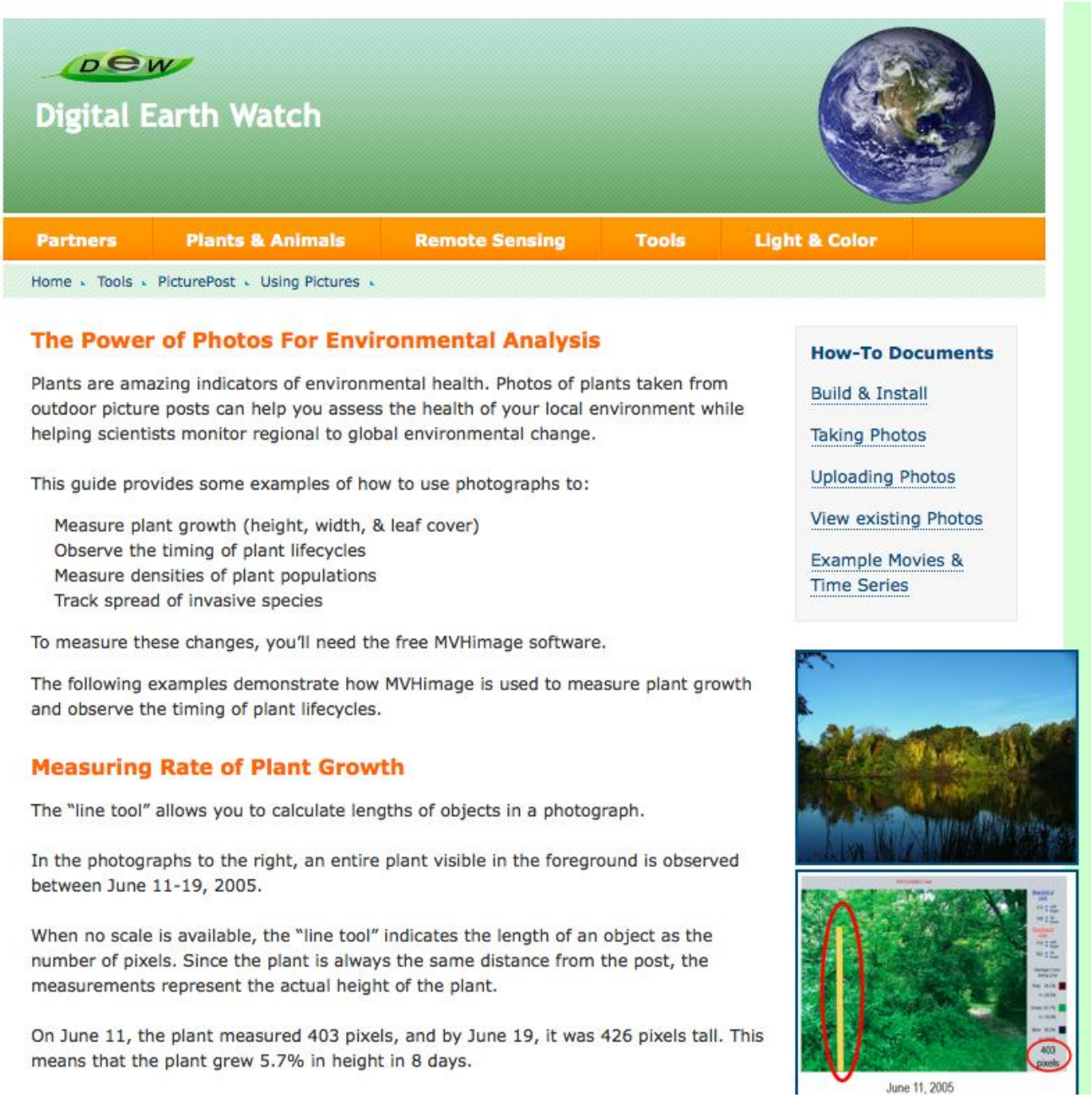
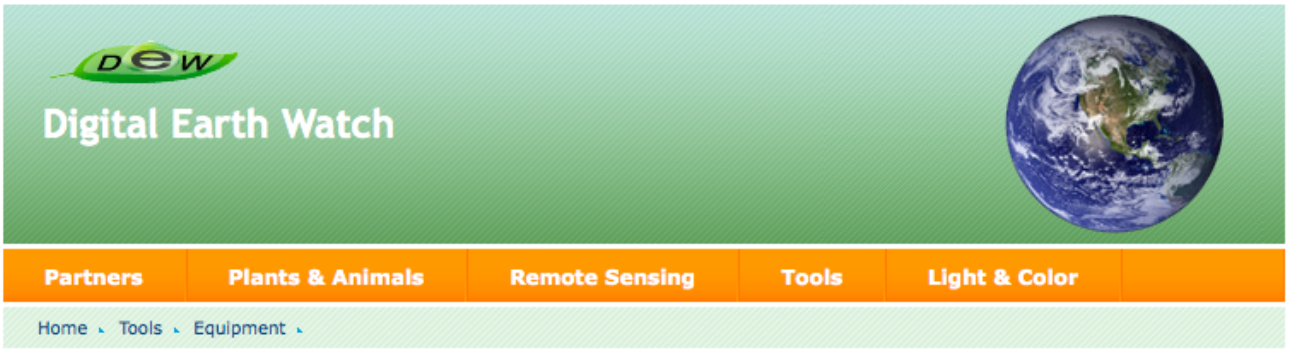


Figure 10: Using Pictures



Sources for Equipment used in "Measuring Vegetation Health"

The following sources are not endorsements of any particular product or supplier, but since one of the goals of this project is to develop and integrate low-cost equipment to support scientific exploration and learning, we did need to post our sources.

Filters: *Purpose*-colored filters are an inexpensive way to look at the world to see what portions of the visible spectrum are being emitted from, transmitted through, or reflected by objects. These durable filters are broad-band, meaning a wide range of wavelengths are transmitted through the filters.

1) **Plant Stress Detections Filters** (see details of filters that compare very well with forester's plant stress detection glasses)

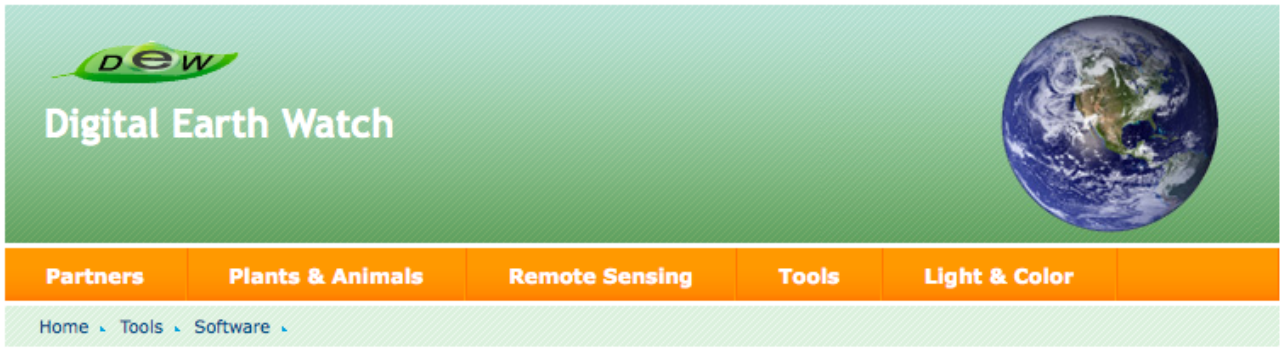
Mike Abdow, Sales (Barbizon has been a long-time supplier for MoS activities; ask about discounts for bulk orders)
Barbizon Light of New England
1-800-935-3920 ext 212
mabdow@barbizon.com

NOTE: one 21"x21" filter sheet costs about $7; Consider calling for all filter needs, including those that follow)

IR Goggles: *Purpose*-provide inexpensive experience in exploring the beginning of the near infrared (IR) portion of the electromagnetic spectrum using one's eyes. Important to do before using digital cameras, which many young people expressed concern about because they believe one can lie with an electronic instrument.

Details on making the goggles are available at Bill Beaty's web site
Bill's web site includes details on what filters to order and where to purchase welder's goggles (~$6-7 apiece) that will hold the proper set of filters.
Consider buying welding goggles at your local hardware store, including Home Depot and Lowes. See goggles that works well for glass-wearers cost about $10 apiece.

Figure 11: Equipment



Software Manuals

Each software program and guide that follows may be downloaded and used for all education uses.

***Measuring Vegetation Health* Software Download**

Programs are listed in the following sequence of concepts: ***color***, ***basics of digital images***, and ***visualization and analysis tools***. Utility programs are also available and are listed at the bottom of the list.

For each concept grouping, software is bundled for one-stop downloading. Or consider downloading all of the programs at once.

Download the proper version software for your computer: **OSX** (Mac), Mac "Classic" (**OS9** and earlier), and Windows (**PC**). Several programs are being rewritten to Java for interactive web activities (no downloading needed) by Tom Whittaker at the University of Wisconsin-Madison's Space Science and Engineering Center. These applet links are marked by "**Java**."

Software Requirements

Programs that *manipulate images* require Quicktime 5 or later to be installed.

If not installed, download for free: Mac PC/Windows.

All software programs are "zipped". You will need the proper freeware utilities installed on your computer.

Many programs, except the color programs, require a screen resolution of at least 1024 x 768.

Figure 12: Software

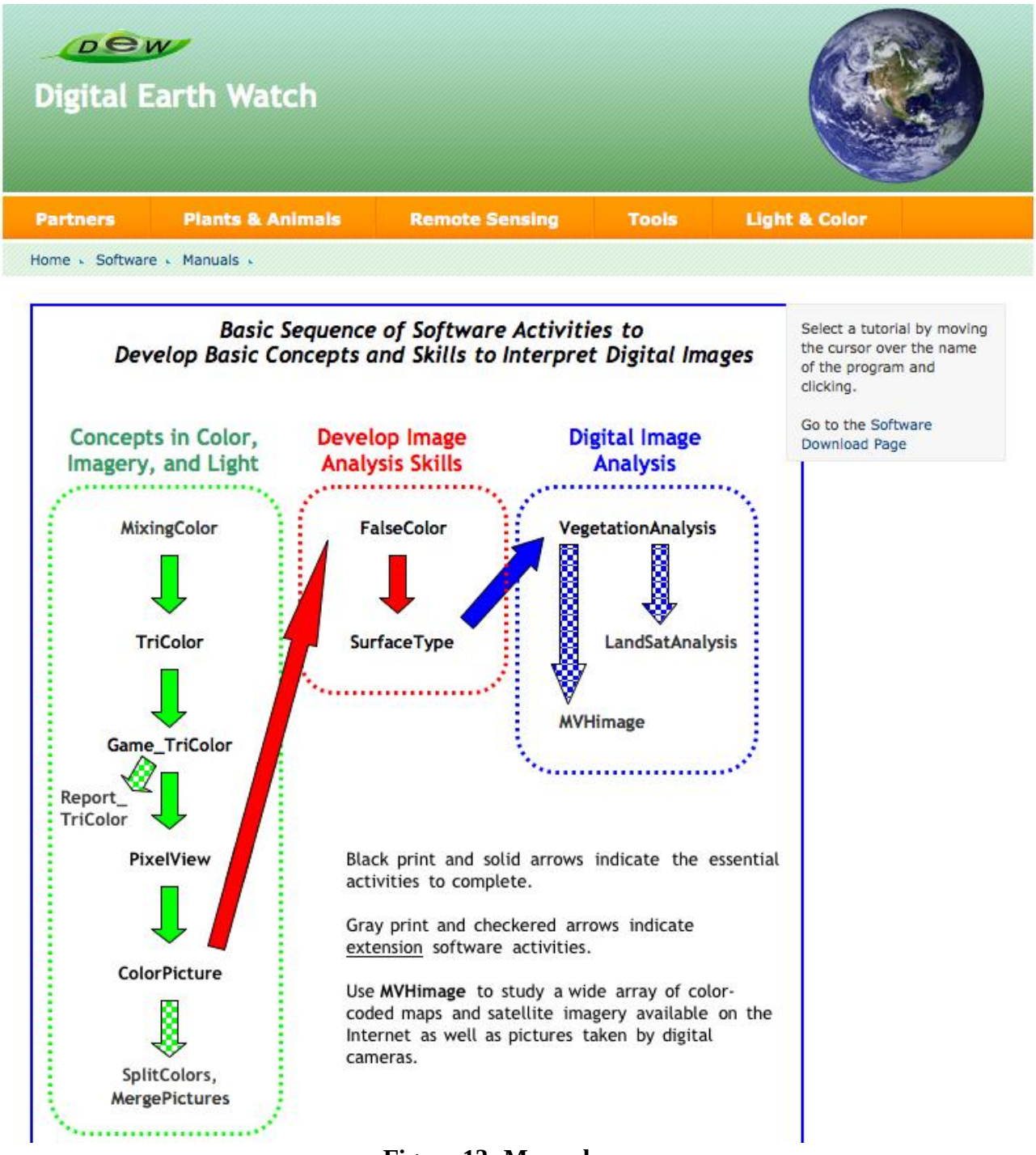


Figure 13: Manuals

APPENDIX I: PICTUREPOST PHOTOGRAPHS

This appendix includes several photographs that we took at the PicturePosts around Fresh Pond during our time in Boston.

Fresh Pond Reservations
PicturePost 1

04-02-08

North

Northeast

East

Southeast

South

Southwest

West

Northwest

Sky

Figure 14: Pictures from Fresh Pond Reservation, PicturePost 1 on April 2, 2008

Fresh Pond Reservation
PicturePost 1

04-08-08

North

Northeast

East

Southeast

South

Southwest

West

Northwest

Sky

Figure 15: Pictures from Fresh Pond Reservation, PicturePost 1 on April 8, 2008

Fresh Pond Reservation
PicturePost 1

04-14-08

North

Northeast

East

Southeast

South

Southwest

West

Northwest

Sky

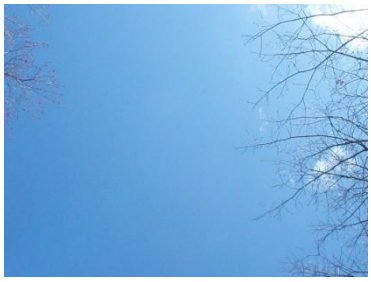


Figure 16: Pictures from Fresh Pond Reservation, PicturePost 1 on April 14, 2008

Fresh Pond Reservation
PicturePost 2

04-14-08

North

Northeast

East

Southeast

South

Southwest

West

Northwest

Sky

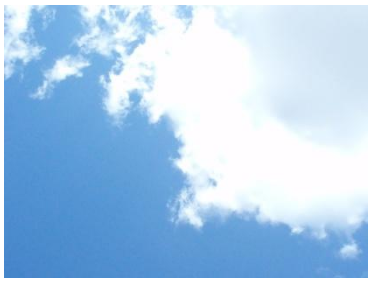


Figure 17: Pictures from Fresh Pond Reservation, PicturePost 2 on April 14, 2008

Fresh Pond Reservation
PicturePost 1

04-22-08

North

Northeast

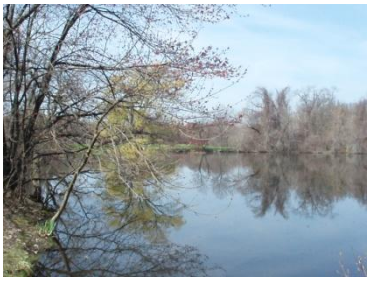
East

Southeast

South

Southwest

West



Northwest

Sky

Figure 18: Pictures from Fresh Pond Reservation, PicturePost 1 on April 22, 2008

Fresh Pond Reservation
PicturePost 2

04-22-08

North

Northeast

East

Southeast

South

Southwest

West

Northwest

Sky

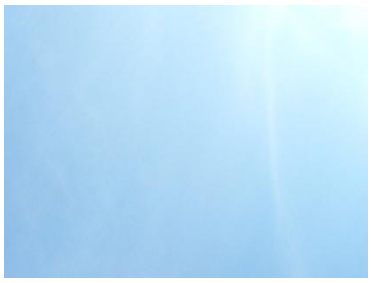


Figure 19: Pictures from Fresh Pond Reservation, PicturePost 2 on April 22, 2008

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